FINAL REPORT:
HEMLOCK ECOSYSTEM INVENTORY AND MONITORING PROJECT OF THE NEW RIVER GORGE NATIONAL RIVER AND GAULEY RIVER NATIONAL RECREATION AREA

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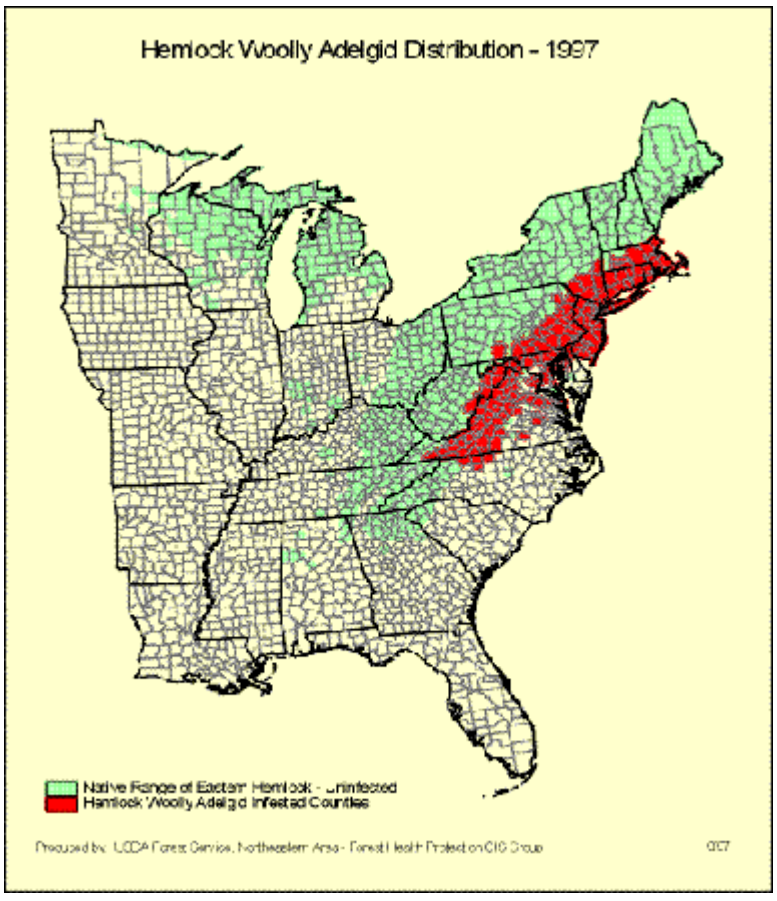

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EXECUTIVE SUMMARY

Thirty-six permanent 400m^2 plots were established during October, 1998, in Fayette, Nicholas, and Raleigh counties, West Virginia. Replicated plots (separated by at least 250m for concurrent wildlife-habitat studies), each containing a visibly significant percentage of intact hemlock (*Tsuga canadensis* (L.) Carrière) tree canopy cover, were randomly chosen across a range of hydric, mesic, and xeric sites. The oldest hemlock trees, over 300 years, were cored in hydric stands along the Meadow and Gauley rivers. There was no evidence of hemlock woolly adelgids (*Adelges tsugae* Annand) on any of the live hemlock trees. Only seven of the 482 individual, live trees that were sampled during November, 1998, had crown-vigor values of <75%. Additional baseline plant-community data (hardwood tree density, hardwood and evergreen sapling density, shrub density, and frequency and cover of all vascular species) were collected during July, 1999. An electronic copy of all raw, baseline data and the Statistical Analysis System (SAS) programs used to summarize these data were given to the New River Gorge National River resource management staff. This report summarizes the significant differences among the various plant-community data collected in the hydric, mesic, and/or xeric plots within five geographic locations (Fayetteville, Wolf Creek, Kates Branch/Grandview, Meadow River, and Carnifex Ferry Battlefield State Park) and provides analytical guidelines for comparing the baseline data with data collected in the future.

GEOGRAPHIC LOCATIONS

C = Carnifex Ferry State Park
M = Meadow River
F = Fayetteville
W = Wolf Creek
G = Grandview
K = Kates Branch

Figure 1. Hemlock Ecosystem Inventory and Monitoring Project: Geographic locations in Fayette, Nicholas, and Raleigh counties, West Virginia.

INTRODUCTION

Background and Justification

A small, aphid-like insect native to Japan, the hemlock woolly adelgid (HWA) (*Adelges tsugae* Annand), was first observed in the Eastern United States in the 1950's (McClure et al. 1996). Since that first sighting in Virginia, the insect has been reported from North Carolina to Massachusetts as well as in six eastern counties of West Virginia. Trees infested with HWA have been observed less than 65 km east of the New River Gorge National River (NERI) and Gauley River National Recreation Area (GARI), in Pocahontas and Greenbrier counties (Figure 1). The HWA feeds directly off the xylem cells of Eastern hemlock (*Tsuga canadensis* (L.) Carrière) needles, causing dessication and eventual death of the tree in many instances (McClure et al. 1996). Although chemical control methods may be effective for protecting individual, ornamental trees (McClure 1995b), biological control agents, i.e., natural insect predators of HWA in Japan (McClure 1995a), show the most promise for preservation of Eastern hemlock forests.

Hemlocks are scattered throughout the NERI in moist coves, along stream corridors, and in mixed conifer/deciduous forests on the rock outcrops rimming the river's gorge. While plant species diversity tends to be lower in hemlock forests relative to adjacent hardwood forests, certain species that are associated with hemlock forests may be negatively affected in its absence (Black and Mack 1976). Because hemlock is a late-successional, long-lived, undesirable timber species that often grows on rocky sites difficult to access, the hemlock forest communities may represent some of the least-disturbed areas in NERI and GARI. If hemlock forests disappear from the landscape, many species of plants, including bryophyte, lily, and orchid species, and some animals, particularly several warbler species associated with this ecosystem, may be adversely affected (Benzinger 1994, Mitchell 1999). Greater understory light levels, stream temperatures, soil nitrate/nitrogen availability, deciduous leaf litter, and primary productivity caused by canopy gaps will negatively impact some bird, trout, and bryophyte species (Evans et al. 1996), and increase the abundance of mid-successional tree species and understory plants (Orwig and Foster 1998), stream algae (Evans et al. 1996), and invasive exotic plants (Orwig and Foster 1998).

Objectives

Other studies suggest that hemlock mortality may be related to site-factors such as soil moisture, elevation, slope and aspect (Evans et al. 1996, Onken 1996), which are compounded by the added stress of HWA infestation. Bonneau et al. (1997) determined that more hemlocks affected by HWA died on warmer, drier southwest- and west-facing slopes, as well as on ridge tops and upper slopes than in cooler,

moister valleys and riparian areas. The hemlocks of the NERI and GARI may or may not be affected by the HWA in the near future. Baseline data were needed to properly assess the impact that HWA infestation may have on hemlock mortality as well as on the associated plant community. The objectives of this study were:

1. Locate and establish permanent vegetation sampling plots in a variety of habitats within the New River Gorge National River and Gauley River National Recreation Area for long-term monitoring.

2. Collect baseline measurements of the overstory, sapling, shrub, and understory vegetation layers within each sampling plot, including data on degree of HWA infestation and hemlock crown vigor.

3. Identify and quantify sources of variation in the baseline data, and recommend a strategy for analyzing subsequent, multi-year comparisons.

METHODS

Study Area and Location of Permanent Vegetation Sampling Plots

A reconnaissance of hemlock stands was conducted in Nicholas County near the confluence of the Gauley and Meadow rivers, and along the New River in Fayette and Raleigh counties, West Virginia, during October, 1998. Thirty-six sampling plots were nonrandomly selected (see **Data Analysis** section) in GARI and NERI hemlock stands in a variety of habitats with varying degrees of soil moisture, elevation, slope and aspect with the intention of gathering the maximum amount of data on biodiversity and rare, threatened and endangered species. Candidate stands were determined with the assistance of GARI and NERI resource management staff familiar with the two areas. For logistical reasons, chosen stands were no more than one mile from a road or trail head. Given the objectives of this study, plots within a stand were assumed to be true replications (as opposed to pseudo-replicates) as long as they were situated at least 250m apart. This minimum distance also was determined great enough to accommodate wildlife-habitat studies (Petra Wood, pers. comm.).

Plots were located at three sites: NEW RIVER NORTH (U.S. Geological Survey 1969a), with 12 plots located along the New River in the vicinity of Fayetteville; NEW RIVER SOUTH (U.S. Geological Survey 1969b), with six plots along the New River east of Beckley; and MEADOW-GAULEY RIVERS (U.S. Geological Survey 1969c), with 18 plots in the vicinity of Mt. Nebo, WV (Table 1). Each plot was identified by a three-character code. The first character of the code represents the geographic location (Figure 1) of the plot: F= Fayetteville, W= Wolf Creek, K= Kates Branch, G= Grandview, M= Meadow River, and C= Carnifex Ferry Battlefield State Park. The

second character equates with the principle study design, which consists of three levels along a moisture gradient; H= Hydric, M= Mesic, and X= Xeric. Each moisture-gradient level was replicated three times, so the third character (1, 2, or 3) signifies a replication number. Detailed plot locations, descriptions, and maps are included in Appendix A. Because of a lack of suitable mesic hemlock stands at the NEW RIVER NORTH site, six mesic plots were placed at the NEW RIVER SOUTH site. Although this created an unbalanced sampling design with respect to site, the three replications of each moisture-gradient were consistently located within the same geographic location. Of those chosen, the most contiguous hemlock stands occurred along drainages in relatively moist, north-facing ravines or slopes along the Meadow (sites MH1, MH2, and MH3), Gauley (sites CH1, CH2, and CH3), and New (sites WH1, WH2, and WH3) rivers, and in a perched wetland situated above the rim of New River Gorge along Fern Creek (sites FH1, FH2, and FH3). Just below the rim of gorges, and on the mid-slopes where an impermeable layer of rock is close to the soil surface, small patches and narrow bands of hemlock trees occur where ground water seeps out or is forced to the surface. Given the dual objectives of monitoring hemlock survival and obtaining the maximum amount of biodiversity data, the remaining hemlock plots were located in these non-contiguous bands or islands of hemlock trees within a cove-hardwood forest matrix on relatively drier sites with western or southern aspects.

Included in the description for each plot in Appendix A are the perimeter angles (i.e., the azimuths between two corner-stakes), which are helpful when trying to relocate the corners. Additional information listed in Appendix A includes an azimuth taken from the center-stake and pointing to the corner where photographic slides of each plot were taken, UTM coordinates, slope, and aspect. Two 35mm color-slide exposures of each plot were taken in November, 1998, and again in April, 1999, from the permanent photo points established at one of the corner markers of each plot (Appendix A). In addition, one 35mm color-slide exposure of two of the four transects (Figure 2) in each plot was taken in July, 1999. The July, 1999, photographs always were taken from the beginning of transects 1 and 3 on each plot (Table 2) pointed toward the corner-stake. All UTM coordinates (magnetic North) were estimated using a Trimble Scout GPS unit with Acu-Lock (i.e., averaging) software in April, 1999. If two slopes are listed it means that the slope varies from one side of the plot to the other. Slopes described as "undulating" refer to a pit-and-mound or boulder-strewn topography. For reference purposes, aspects and slopes of the individual plots were grouped into the major categories listed in Table 3.

Each one of the 36 plots was permanently marked in October, 1998, with four 3/8" rebar corner-stakes protruding 1 to 5 inches above ground (or laying on top of the rock substrate on two of the Meadow River hydric plots), and with a ½" diameter piece of galvanized pipe marking the center of the plot. Rebar and pipe were spray-painted orange on all but the nine Carnifex plots, which were spray-painted white, in October, 1998, and again in July, 1999, when the bulk of the vegetation sampling

took place. A small amount of orange flagging was used to mark the center-stake on each plot. A small amount of orange flagging also was used in plots with dense understory vegetation to mark the corner-stakes. No flagging was used at the Fayetteville (xeric only), Grandview, and Kates Branch plots. In many but not all plots, a rock or the base of a tree or shrub near each corner-stake also was spray-painted.

Voucher specimens were collected of unknown plants sampled within the selected hemlock stands (but not from inside plots), as well as in nearby canopy gaps and along the edges of these stands, that were later identified and included in a collection prepared for the NERI Resource Management herbarium. Fall-flowering species were collected during 1998 and 1999 and additional specimens were collected during the April and July, 1999, sampling periods.

Sampling Design

All plots are 400m^2 (Figure 2) and, depending on the site conditions, were placed either within a stand or an isolated patch of hemlock trees. On sites where hemlock was a co-dominant rather than a dominant tree species, plot-centers were deliberately placed where there was a relatively significant amount of hemlock canopy cover. Most plots are square (20m by 20m), but four of the plots (CX1, FH1, MX2, and WH1) are rectangular (10m by 40m). Rectangular plots were used where a landscape feature, such as a creek bed or rock wall, did not allow placement of a square plot. Plots of similar dimensions have been used in other HWA stand-level monitoring studies (Mahan et al. 1998, Orwig and Foster 1998). Square or rectangular plots were preferable to circular plots because the perimeter can be marked and resampled with less subjectivity than a circular area.

To design a long-term study for documenting changes in all layers of the plant community, four main categories of baseline vegetation data were collected from each hemlock plot:

1. Density data (trees, saplings, shrubs, and vines)
2. Cover data (all vascular plants and structural components)
3. Frequency of occurrence data (all vascular plants)
4. Tree data
   --hemlock (dbh, crown ratio and vigor, straightness, HWA index)
   --pines (dbh, crown ratio and vigor, straightness)
   –all other trees (dbh)

A sampling strategy was chosen that would minimize observer bias and time spent in the field, yet would permit repeated sampling and meaningful statistical comparisons of the same points in space over time. Tree data (category #4) were collected for all

trees ≥8cm dbh in the entire 400m^2 area of each plot. All other vegetation data were subsampled along four transects radiating from the center-stake to the four corners of the plot (Figure 2). Sapling and shrub density was tallied in four 2m-by-10m rectangular belt-transects. Cover estimates of all vascular vegetation were collected at 100 discrete points evenly spaced along four 10m line-transects. Frequency data for understory plants (trees < 8cm dbh and < 1.4m tall, shrubs < 1.4m tall, and all herbaceous species) were collected in twenty 0.25m^2 quadrats evenly spaced along each the four transects. Specific methods used for collecting these data are detailed below.

Each transect was assigned a permanent number, which is listed along with the azimuth (± a few degrees depending on the accuracy of the compass used) from the center-stake to the corner-stake in Table 2. Note that the starting point for transects in the 10m-by-40m plots is 5m from the center-stake, whereas the starting point for transects in the 20m-by-20m plots is 1m from the center-stake (except for transect 3 on plot CM1 and transect 3 on plot FX3, which start 2m from the center-stake).

Hemlock Stand-Age Estimates

A total of 108 hemlock trees, three from each plot, were cored with a tree increment-borer in April, 1999. Whenever possible, one core was made from a tree randomly selected from each of the three largest diameter classes (≥8-14.9, ≥15-24.9, ≥25-34.9, etc.) in each plot. Cores were transferred directly from borer bit into one or more McDonald's® plastic straws (chosen for their large diameter) and the ends sealed with electrical tape. The tape was removed immediately upon returning from the field and the cores were allowed to air-dry inside the straws. Tree rings were counted, without staining, using a dissecting stereo-microscope. If the exact center of the tree was missed in the coring process, or if the radius of the tree was greater than the length of the borer, the total number of rings was estimated. This estimate took into account both the known radius of the tree and the growth rate of any older trees cored at the same geographical location. Average annual growth rates were crudely estimated by dividing the age by the midpoint of diameter-class assigned for each tree.

Tree Diameters, Density, Vigor, Crown Ratio, and HWA Monitoring

All trees that were rooted within or intersecting the outside perimeter of each 400m^2 plot were tallied by species. A tree was defined as any stem ≥8cm diameter at breast-height (dbh). Data for hemlock and pine trees (live and dead) were collected during November, 1998, to coincide with the November-April period in which the current season's HWA population typically exhibits woolly characteristics (Onken et

al. 1994). Each tree was given a crown-vigor class rating, and the extent of HWA infestation of all hemlock trees was rated. Additional data collected for each hemlock and pine tree included the live crown-ratio, and the straightness of the main stem, which identifies uprooted, stressed, or potentially stressed individual trees. Data for all other tree species except hemlock and pines were collected during July, 1999, and included only the dbh and species identification. Dead trees, except for hemlocks and pines, were not tallied by species but were grouped together. Specific types and values of data collected for trees are summarized in Table 4.

Sapling and Shrub Density

All live saplings (trees < 8cm dbh and ≥1.4 m in height), dead hemlock saplings, and live shrubs ≥1.4m in height, were tallied by species in the four 20 m^2 belt-transects nested within each 400m^2 plot (Figure 2) in July, 1999. Based on the methods developed by Martin et al. (1997), each shrub stem that originated ≤10cm above ground level was counted. Except for hemlocks, the total numbers of dead saplings and shrub stems also were tallied, regardless of species.

Stratified Cover Sampling

Percent cover of the various structural and vegetative components listed in Figure 3 was estimated on line-transects by recording presence/absence data at 100 separate points, i.e., at every decimeter along a 10-meter section of nylon tape. Cover data were collected along with the hardwood density, sapling/shrub density, and frequency data during July, 1999. Each transect was vertically stratified, based on the layers, or strata, of vegetation present along that line (Figure 3). Data for live vegetative components (primarily leaf coverage, but also including live boles and stems), dead vegetative components (standing or fallen boles, and stems and branches that were not attached to living trees or shrubs), and structural components were collected. Live vegetative components included hemlocks, pines, hardwoods, and other major groups or growth forms of plants. Note that coverage of dead branches that were attached to trees and shrubs that were still alive were not counted.

The maximum height at which a component intercepted the transect determined which vegetation stratum it was "assigned" to. Except for components "assigned" to the understory stratum, which always were recorded as "0 to 1.4m", the minimum and maximum heights of components in all other strata were determined on each line-transect at the time of sampling. There was no predetermined height range for any of the other strata. Therefore, the same component could have different minimum and maximum heights on different transects in the same plot.

Unlike other sampling techniques that aggregate cover-component data, regardless of height-class, into pre-defined height ranges (e.g., 0-1m, > 1-5m, > 5-10m, etc.), this sampling technique was used to generate cover data for multiple height-classes of the *same* cover component. A cover component was counted in more than one stratum at the same point on a line-transect when it intercepted one or more of the vertical strata below its "assigned" stratum. To illustrate this concept, assume that some of the hemlock trees intercepting a transect are "assigned" to the canopy stratum, and the live crown on these trees ranges in height from 0.5 to 20m. There also are smaller hemlock trees "assigned" to the subcanopy stratum, with live crowns ranging in height from 5 to 15m. There are evergreen shrubs "assigned" to the shrub layer, ranging in height from 0.0 to 3.5m. And there are plants in the understory stratum (always 0.0 to 1.4m). Given this scenario, cover of the canopy hemlock trees will be tallied in four different height ranges; 0.5 to 1.4m (the amount of canopy hemlock in the understory stratum), > 1.4 to 3.5m (the amount of canopy hemlock in the shrub layer), > 3.5 to 15m (the amount of canopy hemlock in the subcanopy), and > 15 to 20m (the amount of canopy hemlock in the canopy). Subcanopy hemlock trees in this example do not intercept any of the lower strata, so all of it is recorded as subcanopy hemlock in the subcanopy layer. Evergreen shrubs will be tallied in two height ranges; 0.0 to 1.4m (the amount of shrub-layer evergreen shrubs in the understory stratum), and > 1.4 to 3.5m (the amount of shrub-layer evergreen shrubs in the shrub layer).

Except for the 1.4m cutoff between the understory and shrub-layer strata, which was determined with a metered stick, the minimum and maximum heights of vegetative strata were visually estimated. The actual height values were not used to analyze cover data. They were only used to vertically sort the strata from highest to lowest. Determining the precise heights of the midstory and canopy layers in the field, in my opinion, was not important. For monitoring changes in the plant community over time, the relevant criteria are the number of strata and the percentage of vegetative cover in each stratum. Counting data for the same component in two or more vertical strata at the same points, I think, will permit detailed analyses of changes in the vertical structure of individual transects over time.

For determining differences among transects at one point in time, however, the <u>total</u> cover (underlined for emphasis in tables and text) was used. The <u>total</u> cover of each component cannot exceed 100 because each of the 100 horizontal points is counted only once in its tabulation, regardless of how many vertical strata are intercepted. For example, if canopy hemlock in the canopy layer is recorded at points 1 through 90 on a line-transect, and canopy hemlock in the understory stratum is recorded at points 10 through 20 and 71 through 76, then the <u>total</u> cover of canopy hemlock is 90%. In another example, if canopy hemlock in the canopy layer only is recorded at points 1 through 50 on a line-transect, with all else being equal, then the <u>total</u> cover of canopy hemlock would be 66% (points 1-50 and 71-76).

Understory Species Frequency

All tree seedling (< 8cm dbh and < 1.4m in height), shrub (< 1.4m in height), and herbaceous species, were identified in twenty 0.25m^2 (1.0m-by-0.25m) quadrats centered every half-meter along each 10m line-transect in July, 1999. Except for vines, all species had to be rooted in the quadrat to be counted. For example, if one or more hemlock seedlings were rooted in five of the twenty quadrats along a transect then, regardless of how many individual hemlock seedlings there were in each quadrat, the percent frequency of occurrence of hemlock on that transect was 25%. The first quadrat-sample was aligned with the 0.5-m mark along the nylon tape, then at the 1.0-m, 1.5-m, 2.0-m....and 10.0-m marks (Figure 4).

Data Analysis

Except for comparisons of hemlock-stand age, analyses were done separately for each of five geographic locations (Table 1) for two reasons. First, the sampling design was unbalanced. All three moisture-gradient classes did not occur at each geographic location. Second, inherent differences in plant communities among geographic locations due to land management strategy, human disturbance, and deer density could not be statistically accounted for in a study of this magnitude. Plot was considered a fixed effect, rather than a random effect, because the plots were not randomly selected. Therefore, all interpretations of statistical tests apply only to the specific 36 plots sampled in this study. Replicated samples along transects within a plot, however, were considered random.

Index variables pertaining to the health of hemlock trees (i.e., HWA class, vigor class, and straightness) were compared using chi-square contingency tests. Diameter-class distributions of the number and crown-ratio of live hemlocks and the number of live hardwood trees were compared in the same way. Since the index variables and diameter-classes were ordinally scaled, the Cochran-Mantel-Haenszel (CMH) row-mean-score statistic (Stokes et al. 1995) was used to test the null hypothesis that there was no difference in the distribution of the index variable or diameter-classes between moisture-gradient classes (hydric, mesic, and/or xeric).

Differences in tree density and crown ratio data, shrub and sapling density data, vertical vegetative-structure (cover) data, and understory species frequency data were quantified using analysis of variance (ANOVA) techniques. Means were compared between moisture-gradient classes separately at each of five geographic locations (Table 1) using a nested ANOVA model, testing the same null hypothesis of no difference between hydric, mesic, and/or xeric plots. Indexes of diversity and dominance, including number of species (Species Richness), the Brillouin index (Diversity Index) for non-random samples, and the Berger-Parker index (Dominance

Index) were compiled for selected groups of plant species based on the formulas described in Magurran (1988). These indexes were compared between moisture-gradient classes separately at each of five geographic locations using the same nested ANOVA model that was used for the attribute (density or frequency) that the index was derived from. Independent variables, in the order of nesting, included moisture-gradient class (fixed), the replicated plot effect (fixed) and transect (random). The random effect, which included four replicated transects in each plot, was used in the denominator of each F-test when it contributed significantly ($P \leq 0.05$) to the error variance; the regression mean square was used when the random effect was not significant. The ANOVA model for tree measurements (i.e., vigor, straightness, crown ratio, and density) did not include the random effect, so these significance tests always were based on the regression mean square. The ANOVA model used for comparing hemlock crown ratios included an additional nested effect, diameter-class, whose significance was compared with the results of the chi-square contingency tests on crown-ratio distributions. The Waller-Duncan k-ratio t-test was used when cell sample-sizes were even, and Tukey's studentized range test was used when cell sample-sizes were uneven, to determine differences among the main effect of moisture-gradient class. The Type III sums of squares (each effect adjusted for all other effects in the model) was used for determining significance of the fixed effects. All means reported in the results as being "greater" or "different" were based on a 95% statistical probability (i.e., a significance level of $P \leq 0.05$). No data transformations were made — all numbers reported are actual means. Because of their confounded distribution among the fixed effects, differences among aspect and slope (Table 3) were not formally included in statistical models, but were noted in the discussion section if they appeared to contribute to the error variance. All data were entered into ASCII computer files and analyzed with Statistical Analysis System, Inc.® software for Windows, Version 6.12 (SAS Institute, Inc. 1989). A copy of the ASCII-data files and SAS programs was included with the written report submitted to NERI.

As previously mentioned, only hemlock-stand ages were compared both among geographic locations and moisture-gradient classes. Differences in average age of cored trees were compared between moisture-gradient classes within each geographic location using a fixed-model, nested analysis of variance that included geographic location (fixed), moisture-gradient class (fixed), and the replicated plot effect (fixed).

RESULTS

Hemlock Stand-Age Estimates

An ANOVA comparison of stand ages among the three moisture-gradient classes indicated that hydric plots (n= 36, $\bar{x}$= 156.3 years) were older than mesic (n= 36, $\bar{x}$= 74.3) and xeric (n= 36, $\bar{x}$= 69.2) plots. The hydric plots, at least the ones non-

randomly selected for this study, tended to be less accessible (rockier, further from existing roads, and/or with poorly drained soils) than the other plots. Valid orthogonal comparisons of the balanced combinations of hydric, mesic, and/or xeric plots present at two geographic locations indicated that hydric and xeric plots at Carnifex Ferry State Park (n= 18, $\bar{x}$= 134.1) were older than at Fayetteville (n= 18, $\bar{x}$= 90.1) and Wolf Creek (n= 18, $\bar{x}$= 97.9), and that the hydric and xeric plots at Meadow River (n= 18, $\bar{x}$= 128.9) also were older than those at Fayetteville and Wolf Creek. The orthogonal (i.e., balanced) comparisons among moisture-gradient classes nested within each geographic location are given in Table 5 (in the rows labeled "Overall") along with estimates of average growth rates (cm/year) and hemlock tree ages listed by diameter-class. It is clear from this table that the largest-diameter trees also occurred in the hydric plots at Carnifex and Meadow River.

Tree Diameters, Vigor, Crown Ratio, and HWA Monitoring

Of the 518 hemlock trees ≥8cm dbh in all 36 hemlock plots that were measured during November, 1998, 36 were dead (Figure 5). Most trees appeared to be very healthy, with 334 of the 482 live trees (69.3%) with vigor= 1 (> 95% healthy crown), 141 (29.3%) with vigor= 2, and only seven trees (1.5%) with vigor= 3. Most trees were more or less straight, with 454 (94.2%) leaning 45 degrees or less, 20 (4.1%) leaning at an angle of > 45 to 90 degrees, and eight trees (1.7%) with a > 90 angle measured between the base and top of the tree. Since there was no sign of adelgids on any of the 36 plots, the HWA index was the same (HWA= 4) for 100% of the 482 live hemlock trees sampled.

Since all HWA index values were the same, it was not necessary to compare this value among moisture-gradient classes. Results of the contingency analysis for the vigor and straightness indexes, however, are listed in Tables 6 and 7, respectively. Hemlock crown vigor at Meadow River was greatest on the mesic plots, where 100% of the 54 trees sampled were in vigor class 1 (> 95%). Vigor at Fayetteville was greater on the xeric plots than on the hydric plots, where 50% of the 40 hydric-plot trees were in vigor classes 2 and 3 compared with only 17% of the xeric-plot trees. The only significant difference observed in straightness of hemlock trees (Table 7) was in the comparison between the mesic plots at Grandview and Kates Branch. Over 10% of the trees sampled at Grandview were leaning at an angle greater than 45°.

Hemlock and hardwood diameter-class distributions are shown in Tables 8 and 9, respectively. Nearly one-third of the 482 live hemlock trees were in the smallest (8-14cm) diameter class, whereas the greatest proportion (31.5%) of live hardwood trees was in the 15-24 cm diameter class. There was a significantly greater proportion of small-diameter hemlock trees in the xeric plots at Carnifex Ferry State Park than in the hydric and mesic plots. It also appears that there was a greater percentage of

large-diameter trees in the hydric plots at Carnifex than in the mesic and xeric plots. Conversely, there was a significantly greater proportion of small-diameter hardwood trees in the hydric plots at Carnifex, at least in comparison to the proportion of small-diameter trees in the mesic plots. Small-diameter hardwood trees were the median in hydric plots at Fayetteville and Wolf creek when compared to the respective diameter-class distributions of the xeric plots.

The ANOVA used to determine if there were differences in hemlock crown ratios between the moisture-gradient classes also accounted for the variation between plots nested within each moisture-gradient class and between diameter classes nested within each plot. Even after adjusting for the variance due to these nested sampling errors, crown-ratio means at Carnifex were greater on the mesic plots (n= 25, $\bar{x}$= 76.1%) than on the hydric (n= 19, $\bar{x}$= 62.4%) and xeric (n= 57, $\bar{x}$= 57.2%) plots. Xeric plot means at Meadow River (n= 19, $\bar{x}$= 87.9%) were greater than hydric (n= 43, $\bar{x}$= 61.3%) and mesic (n= 54, $\bar{x}$= 57.5%) plots, and the xeric plots at Wolf Creek (n= 38, $\bar{x}$= 69.0%) were greater than the hydric plots (n= 58, $\bar{x}$= 43.0%). There was no significant difference in crown ratios between the Fayetteville hydric plots (n= 40, $\bar{x}$= 51.9%) and xeric plots (n= 47, $\bar{x}$= 51.1%), and no significant difference between the mesic plots at Grandview (n= 39, $\bar{x}$= 67.7%) and Kates Branch (n= 43, $\bar{x}$= 73.6%). Chi-square comparisons of the distribution of crown ratios by diameter class (Table 10) indicated that there were proportionately more 8-14 cm trees at Carnifex with smaller crown ratios on the xeric plots than on the hydric and mesic plots. Differences (indicated with an asterisk next to the diameter class) at Meadow River, Wolf Creek, and Fayetteville all indicated proportionately more trees with greater crown ratios on the xeric plots.

Density, Stratified Cover, and Understory Species Frequency

There were few significant differences in cover (%) of the dead vegetative components and structural components (Figure 3) sampled on line-transects (Table 11). There was more coverage of dead woody stems at Carnifex on the hydric plots than on the mesic or xeric plots, and less coverage of dead boles at Wolf Creek on the hydric plots than on the xeric plots. Other means that would appear to be significantly different were not due to the significant variability attributed to the nested effects (i.e., plot and transect) in the ANOVA model.

Tables 12-16 compare moisture-gradient class means of density, cover, frequency, and diversity for selected species or groups of plants. Data for each one of the five geographic locations are on a separate table. Cover values in these tables pertain to the total cover (%) of that species or group in the "assigned" stratum, as defined in the methods. Density (n), for each species of tree, and for each sapling and shrub species, is listed by plot in Appendixes B and C, respectively. Total cover means

for all vegetative components (both live and dead), and all structural components are listed by plot and stratum in Appendix D. Note that the total cover data from the low midstory and high midstory strata were combined in Tables 12-16. Appendix E includes a list of not only the total cover in the "assigned" stratum, but also any cover measured for that component in the other vertical strata below its "assigned" stratum. Minimum and maximum heights of each stratum are included. Data are listed in Appendix E by transect for each plot, but only for hemlocks, hardwoods, and shrubs. Frequency of occurrence (%) means for all species of plants (except mosses, which are grouped together) sampled in 0.25 m^2 quadrats are listed by plot in Appendix F.

ANOVA tests based on frequency of occurrence of all growth forms (the first row of Tables 12-16) indicated that Species Richness was significantly lowest in the hydric plots at all geographic locations except Fayetteville. At Carnifex (Table 12) and Meadow River (Table 13), Species Richness was greatest on mesic plots. Species Richness also was greater on the mesic Grandview plots than on the mesic plots at Kates Branch (Table 16). Frequency of hemlock-tree seedlings and great laurel (*Rhododendron maximum*) was greatest in hydric plots at Meadow River. Great laurel also occurred more frequently on the hydric plots at Wolf Creek (Table 15), while all shrub species combined were more frequent on the hydric plots at Fayetteville (Table 14). Understory vine frequency, primarily greenbriers (*Smilax* spp.), was lowest in hydric plots at Carnifex, Fayetteville, and Wolf Creek. Bryophytes occurred more frequently in the hydric plots at Carnifex and Wolf Creek, and ferns were most frequently sampled in hydric plots at Meadow River. Broadleaf herb frequency on mesic plots at Carnifex was greater than on hydric and xeric plots.

Looking at tree density, there were more hemlocks at Carnifex (Table 12) on xeric plots than on hydric plots. The fewest hemlock trees at Meadow River (Table 13) were on xeric plots, while density of all other trees at Meadow River was greater on the xeric plots than on the mesic plots. Tree Species Richness at Meadow River was lower on the hydric plots than on the xeric plots. Diversity and Dominance indexes based on tree density were greatest on xeric plots at Meadow River, but were lower on xeric plots at Fayetteville (Table 14). Density of all shrub and sapling species was greatest on hydric plots at all geographic locations. Great laurel density was greater on hydric plots at Meadow River, Fayetteville, and Wolf Creek (Table 15). There were more hemlock saplings counted in the hydric plots at Carnifex. Shrub Species Richness and Dominance Index were lowest in the mesic plots at Meadow River, where the Dominance Index also was highest in the xeric plots. Dominance Index was greater in the hydric plots at Fayetteville.

Looking next at the comparisons of total (i.e., the sum of all strata — as defined in the methods) cover of trees, it is clear that hemlocks dominated in the subcanopy, and hardwoods dominated in the canopy, of xeric plots at Carnifex (Table 12) and that there was more total cover of hemlocks in the subcanopy of xeric plots than in either

of the other moisture-gradient classes. There was no hardwood canopy cover in the hydric plots at Carnifex, where total canopy cover of hemlocks was greater than on the mesic and xeric plots. Variance among the replicated plots (Appendix D) and/or transects (Appendix E) at Meadow River overshadowed differences in total cover of trees in all but the midstory hardwoods, which was greatest on xeric plots (Table 13). There was greater total canopy cover of hemlocks at Kates Branch than at Grandview (Table 16). Evergreen shrub total cover, in both the shrub layer and understory, was greatest in hydric plots at all geographic locations. Total cover of ferns was greatest on hydric plots at Meadow River.

DISCUSSION

The hemlock stands at NERI and GARI that are represented by the 36 hemlock ecosystem sampling plots tended to be relatively low in species diversity. Not including mosses and lichens, at least 97 vascular plant species (Gleason and Cronquist 1991) were encountered (Appendix G). Most plots, however, included only a small portion of the total species list. The mesic plots, particularly at Carnifex and Grandview, tended to have the greatest diversity of understory species, probably because the mesic plots at Carnifex and Grandview were centered on small, isolated patches of hemlock trees surrounded by hardwood forest. Hydric plots usually contained a prominent *Rhododendron maximum* shrub layer, but it was patchy enough on the replicated transects in some plots to result in non-significant main-effect (i.e., trtmt) mean comparisons. The xeric plots at Meadow River were relatively moister, and included relatively more *Rhododendron maximum* and other evergreen shrubs, than the xeric plots at the other geographic locations. Ferns and particularly mosses were more prominent in the hydric Meadow River plots than at the other geographic locations, indicating a low level of site disturbance at Meadow River. These pristine hemlock stands no doubt took centuries to become established on top of the boulder fields adjacent to the walls of the Meadow River gorge. The oldest of the cored hemlock trees, some over 320 years-old, were in the hydric plots at Meadow River and Carnifex Ferry. The total number of individual hemlock trees in each plot varied from three in one of the hydric plots at Carnifex to 28 in one of the xeric plots, also at Carnifex. Carnifex Ferry State Park is not subject to commercial development, but because there are fewer large boulders, no deer hunting, and much more human disturbance at Carnifex, the plant-community structure in the Meadow River plots is more complex.

Given that this report has satisfactorily identified the sources of variation in the baseline data, the question remaining is how to determine if the data that will be collected in subsequent years differ significantly from the baseline data collected in 1998 and 1999. This baseline study was designed to identify the response of certain plant community attributes to environmental factors thought to have an effect on the

expected response. Two types of statistical procedures were used to determine if a significant difference in response was related to the level of one or more environmental factors; contingency tables (for categorical data), and analysis of variance or ANOVA (for continuous data).

The primary environmental factor examined in the baseline study was called moisture-gradient class. Twelve of the 36 hemlock ecosystem monitoring plots were deliberately selected on north-facing aspects, seepage areas, or on otherwise wet places like the perched wetland adjacent to Fern Creek, to represent the "hydric" moisture-gradient class. Twelve plots were deliberately placed on south- and west-facing slopes, and/or dry ridge tops to represent xeric conditions. The 12 "mesic" plots were selected to represent conditions in-between the wet and dry ends of the moisture gradient. A plot that was classified "xeric" at one geographic location, however, did not necessarily look the same as a "xeric" plot at any of the other geographic locations because of inherent differences in sites. Accounting for the inherent differences between geographic locations was beyond the scope of this study so, except for comparisons of hemlock stand-age, all statistical tests were applied separately for the five geographic locations listed in Table 1.

For the baseline data analyses, contingency tables consisted of *s* rows of moisture-gradient classes and *r* columns of the response variable, where:

s= 3 (hydric, mesic, and xeric) for Carnifex and Meadow River
s= 2 (hydric and xeric) for Fayetteville and Wolf Creek
s= 2 (Grandview and Kates Branch) for the two sets of mesic plots

and

r = 5 for hemlock crown-vigor (Table 6)
r = 3 for hemlock straightness (Table 7)
r = 10 for hemlock diameter-class (Table 8)
r = 8 for hardwood diameter-class (Table 9)
r = 5 for hemlock crown-ratio (Table 10).

Since there was only one year of baseline data, the distribution of the response variable was quantified with the Cochran-Mantel-Haenszel (CMH) mean-score statistic to determine if the response was the same in each row.

One way to quantify the differences between future analyses involving repeated measures of the same response variables on the same plots would be to substitute year for moisture-gradient class in the rows of the contingency table, so that *s* would be equal to the number years of data being compared. To do this, the data first should be analyzed separately for each geographical location (option (1) in Table 17), then also for each moisture-gradient class (i.e., trtmt) within each geographic location (analysis option (2) in Table 17) if there is a statistically significant trend between the

year and trtmt effects. The Mantel-Haenszel correlation statistic, labeled "Nonzero Correlation" on SAS output (Stokes et al. 1995), should be used to determine if the trend is significant. The Mantel-Haenszel row-mean-score statistic, labeled "Row Mean Scores Differ" on SAS output would be used to compare the distribution of the response variable between years. Future comparisons of HWA index would use the same methods that are described for crown-vigor in Table 17.

In general, the nested ANOVA model that was used to analyze the baseline data was:

Response = Effect #1 + Effect #2 + ... + Effect #n + Residual Error.

The response variables included density, cover, frequency, and the diversity indices reported in Tables 12-16. The hemlock crown-ratio analysis included the effect of diameter class, and the effect of geographic location was included in the analysis of hemlock stand-age (Table 5.) Otherwise, the independent variables in ANOVA models included two fixed effects (moisture-gradient class and plot), and, except for tree density responses, also included the random transect effect. Baseline data-analysis ANOVA models as well as the proposed models for future, multi-year analyses on repeated measurements of the same response variables are listed in Table 18. The least-square-mean comparison added to the multi-year models, which starts with the word "lsmeans" in the SAS programming statements, can be used to compare moisture-gradient class (i.e., trtmt) means between years when the trtmt*year interaction effect is significant. The number of lsmeans comparisons that are statistically valid, however, is limited by the degrees of freedom (df) in the interaction effect, so caution is advised when interpreting these results. There are undoubtedly more sophisticated ways to analyze these data than with the ones chosen and recommended here. Consultation with a professional statistician may lead to alternative methods for analyzing the baseline data as well as the data that will be collected in the future.

The variable-height method of estimating the cover of vegetative strata is used effectively by The Nature Conservancy in community-classification sampling (Dean Walton, pers. comm.). No attempt was made to analyze these data, shown in Appendix E, but multi-year comparisons on specific plots may be useful for tracking changes in the height and vertical structure of plants in the individual plots over time. Interpreting these changes also may be useful in explaining future changes, if they occur, in the bird community or in other ongoing wildlife-habitat studies (James and Shugart 1970). Combining hemlock tree cover data with hemlock crown-ratio data may shed additional light on interpretation of any future changes in community structure.

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Table 1. Geographic locations of the 36 hemlock vegetation monitoring plots at three sites in south-central West Virginia.

Site	Geographic location	Moisture Gradient			
		Hydric	Mesic	Xeric	Total
MEADOW-GAULEY RIVERS (Summersville Dam Quadrangle):					
	Carnifex Ferry State Park	3	3	3	9
	Meadow River	3	3	3	9
NEW RIVER NORTH (Fayetteville Quadrangle):					
	Fayetteville	3	-	3	6
	Wolf Creek	3	-	3	6
NEW RIVER SOUTH (Prince Quadrangle):					
	Grandview and Kates Branch	-	6	-	6
	Column Totals	12	12	12	36

Table 2. Transect starting points (distance in meters) and azimuths (from magnetic north) measured from the center-stake of each hemlock plot. Each plot is identified by a three-character code. The first character of the code represents the geographic location of the plot: F= Fayetteville, W= Wolf Creek, K= Kates Branch, G= Grandview, M= Meadow River, and C= Carnifex Ferry State Park. The second character equates with the principle study design, which consists of 3 levels along a moisture gradient; H= Hydric, M= Mesic, and X= Xeric. The third character is the replication number.

	Transect 1		Transect 2		Transect 3		Transect 4	
Plot	Starting Point	Azimuth	Starting Point	Azimuth	Starting Point	Azimuth	Starting Point	Azimuth
CH1	1	347	1	79	1	168	1	265
CH2	1	33	1	122	1	208	1	302
CH3	1	14	1	108	1	196	1	284
CM1	1	55	1	135	2	237	1	328
CM2	1	346	1	75	1	167	1	258
CM3	1	340	1	70	1	160	1	248
CX1[a]	5	20	5	172	5	195	5	353
CX2	1	2	1	91	1	180	1	270
CX3	1	64	1	157	1	248	1	336
FH1[a]	5	20	5	45	5	206	5	234
FH2	1	100	1	182	1	276	1	4
FH3	1	22	1	110	1	200	1	294
FX1	1	324	1	54	1	144	1	234
FX2	1	45	1	134	1	225	1	315
FX3	1	2	1	92	2	182	1	272
GM1[b]	1	110	1	175	1	260	1	310
GM2	1	48	1	136	1	224	1	316
GM3	1	46	1	136	1	222	1	314
KM1	1	222	1	318	1	46	1	136
KM2	1	274	1	358	1	90	1	180
KM3	1	304	1	32	1	128	1	218
MH1	1	22	1	106	1	199	1	290
MH2	1	73	1	167	1	259	1	347
MH3	1	4	1	95	1	185	1	273
MM1	1	360	1	90	1	180	1	270
MM2	1	22	1	110	1	204	1	298
MM3	1	312	1	48	1	122	1	232
MX1	1	342	1	78	1	154	1	254
MX2[a]	5	336	5	122	5	148	5	308
MX3	1	320	1	40	1	140	1	230
WH1[a]	5	44	5	75	5	216	5	244
WH2	1	3	1	95	1	175	1	276
WH3	1	16	1	106	1	204	1	292
WX1	1	20	1	110	1	196	1	290
WX2	1	49	1	135	1	225	1	319
WX3	1	33	1	122	1	208	1	306

[a] Perimeter dimensions on these plots are 10x40m. All other plots are 20x20m.
[b] Transects 1 and 4 in plot GM1 do not point to the plot corners; they were moved to prevent the transects from crossing a creek bed. A small rock spray-painted orange was placed at the 10-m mark on each of these transects.

Table 3. Plots grouped by slope and aspect. Each plot is identified by a three-character code. The first character of the code represents the geographic location of the plot: F= Fayetteville, W= Wolf Creek, K= Kates Branch, G= Grandview, M= Meadow River, and C= Camifex Ferry State Park. The second character equates with the principle study design, which consists of 3 levels along a moisture gradient; H= Hydric, M= Mesic, and X= Xeric. The third character is the replication number.

ASPECT

Flat, North-, or East-Facing

Plot	Aspect
CH1	flat
CX3	NW
FH1	Flat
FH2	Flat
GM1	NNW
GM2	N
GM3	N
KM1	Flat
KM2	Flat
MH1	N
MH2	N
MH3	NNE
WH2	NE
WH3	ENE
WX2	NE
WX3	E

South- or West-Facing

Plot	Aspect
CH2	WNW
CH3	SW
CM1	SE
CM2	SSE
CM3	W
CX1	S
CX2	S
FH3	SW
FX1	S
FX2	S
FX3	W
KM3	S
MM1	W
MM2	W
MM3	S
MX1	SSW
MX2	W
MX3	SW
WH1	SSE
WX1	W

SLOPE

None (0) or Slight (1) Slope

Plot	Slope
CX1	1
FH1	0
FH2	0
FX2	0
KM1	0
KM2	0
KM3	1
MM1	1

Moderate (2) Slope

Plot	Plot
CH1	GM3
CH2	MH1
CM1	MM2
CM2	MX2
CM3	WH1
CX3	WH2
FH3	WX1
GM1	WX2
GM2	WX3

Moderately Steep (3) to Steep (4)

Plot	Slope
CH3	3
CX2	3
FX1	3
FX3	3
MH2	4
MH3	3
MM3	4
MX1	4
MX3	4
WH3	4

Table 4. Types and descriptions of data collected for each individual tree (≥8cm dbh) occurring on each 400m^2 plot during November, 1998, and July, 1999.

Data Type	Description	Species (Month) Measured
dbh	Diameter at breast height, measured in centimeters, using a dbh tape	Hemlock (November) Pines (November) All other trees (July)
Live Crown Ratio	Percentage of total tree height with live foliage (visually estimated)	Hemlock (November) Pines (November)
Crown Vigor	Index of the health of the Live Crown, in terms of branch mortality, twig dieback, foliage discoloration, and/or leaf dwarfing (Onken et al. 1994). The entire crown was inspected using binoculars: 1= > 95% healthy crown 2 = > 75-95% 3= > 50-75% 4 = > 25-50% 5 = > 0-25% 6 = snag/dead	Hemlock (November) Pines (November)
Straightness	Index of the angle or slope between the base and top of the tree (visually estimated): 1= 0-45 degrees (straight) 2= > 45-90 degrees (leaning/bowed to horizontal) 3= > 90 degrees (severely bowed, or uprooted facing down slope)	Hemlock (November) Pines (November)
HWA	Index of hemlock woolly adelgid infestation severity: 1 = heavily speckled and visible from 30m 2 = moderately speckled 3 = lightly speckled — only a few scattered specks 4 = none	Hemlock (November)

Table 5. Mean ages and growth rates (cm/year) of hemlock trees cored by diameter class, April, 1999. Overall mean-age orthogonal contrasts between moisture-gradient classes within a geographic location (row) followed by the same capital letter were not significantly different ($P \leq 0.05$). Average annual growth rate were estimated by dividing the mean age by the midpoint of diameter-class assigned for each tree.

		Hydric Plots			Mesic Plots			Xeric Plots		
Geographic Location	**DBH Class**	**Number of trees**	**Mean Age**	**Growth rate**	**Number of trees**	**Mean Age**	**Growth rate**	**Number of trees**	**Mean Age**	**Growth rate**
Carnifex Ferry State Park	15-24	-	-	-	1	60.0	3.0	3	51.0	2.6
	25-34	1	115.0	3.8	2	73.5	2.5	5	58.6	2.0
	35-44	-	-	-	3	67.7	1.7	-	-	-
	45-54	-	-	-	1	107.0	2.1	1	57.0	1.1
	55-64	1	222.0	3.7	2	116.0	1.9	-	-	-
	65-74	4	216.5	3.1	-	-	-	-	-	-
	75-84	1	280.0	3.5	-	-	-	-	-	-
	85-94	-	-	-	-	-	-	-	-	-
	95-104	1	222.0	2.2	-	-	-	-	-	-
	Overall	9	212.2A	3.1	9	83.2B	2.1	9	55.9B	2.1
Meadow River	15-24	1	88.0	4.4	1	94.0	4.7	2	57.0	2.9
	25-34	1	104.0	3.5	3	85.3	2.8	3	57.3	1.9
	35-44	1	126.0	3.2	3	78.7	2.0	4	60.0	1.5
	45-54	-	-	-	2	76.5	1.5	-	-	-
	55-64	4	251.8	4.2	-	-	-	-	-	-
	65-74	1	198.0	2.8	-	-	-	-	-	-
	75-84	1	272.0	3.4	-	-	-	-	-	-
	85-94	-	-	-	-	-	-	-	-	-
	95-104	-	-	-	-	-	-	-	-	-
	Overall	9	199.4A	3.8	9	82.1B	2.5	9	58.4B	1.9
Fayetteville	15-24	-	-	-				2	68.5	3.4
	25-34	3	73.0	2.4				1	71.0	2.4
	35-44	-	-	-				2	83.5	2.1
	45-54	3	85.3	1.7				1	93.0	1.9
	55-64	3	109.7	1.8				3	116.7	1.9
	65-74	-	-	-				-	-	-
	75-84	-	-	-				-	-	-
	85-94	-	-	-				-	-	-
	95-104	-	-	-				-	-	-
	Overall	9	89.3A	2.0				9	90.9A	2.3

Table 5. Continued

Geographic Location	DBH Class	Hydric Plots			Mesic Plots			Xeric Plots		
		Number of trees	Mean Age	Growth rate	Number of trees	Mean Age	Growth rate	Number of trees	Mean Age	Growth rate
Wolf Creek	15-24	1	152.0	7.6				1	64.0	3.2
	25-34	3	105.7	3.5				3	72.7	2.4
	35-44	2	81.0	2.0				2	74.0	1.9
	45-54	2	189.5	3.8				3	71.7	1.4
	55-64	1	107.0	1.8				-	-	-
	65-74	-	-	-				-	-	-
	75-84	-	-	-				-	-	-
	85-94	-	-	-				-	-	-
	95-104	-	-	-				-	-	-
	Overall	9	124.1A	3.5				9	71.7B	2.1
Grandview	15-24				2	45.0	2.3			
	25-34				5	71.6	2.4			
	35-44				2	85.5	2.1			
	45-54				-	-	-			
	55-64				-	-	-			
	65-74				-	-	-			
	75-84				-	-	-			
	85-94				-	-	-			
	95-104				-	-	-			
	Overall				9	68.8	2.3			
Kates Branch	15-24				1	44.0	2.2			
	25-34				4	61.5	2.1			
	35-44				2	65.0	1.6			
	45-54				2	73.5	1.5			
	55-64				-	-	-			
	65-74				-	-	-			
	75-84				-	-	-			
	85-94				-	-	-			
	95-104				-	-	-			
	Overall				9	63.0	1.8			

Table 6. Distribution of crown-vigor, an index of the health of the live crown, for 482 live hemlock trees sampled in November, 1998. The Cochran-Mantel-Haenszel mean-score statistic (χ^2), significance level (P), degrees of freedom (df), and total number of trees (n) are listed for each comparison between moisture gradient classes within each geographic location.

Geographic Location	Moisture-Gradient Class		Hemlock Crown-Vigor Class (%)				
			> 95	> 75 to 95	> 50 to 75	> 25 to 50	> 0 to 25
Carnifex Ferry State Park	Hydric	n	11	8	0	0	0
		%	57.9	42.1			
χ^2 = 0.288 P = 0.866 df = 2 n = 101	Mesic	n	16	9	0	0	0
		%	64.0	36.0			
	Xeric	n	33	24	0	0	0
		%	57.9	42.1			
Meadow River	Hydric	n	34	9	0	0	0
		%	79.1	20.9			
χ^2 = 16.191 P = 0.001 df = 2 n = 116	Mesic	n	54	0	0	0	0
		%	100.0				
	Xeric	n	13	6	0	0	0
		%	68.4	31.6			
Fayetteville	Hydric	n	20	19	1	0	0
		%	50.0	47.5	2.5		
χ^2 = 10.965 P = 0.001 df = 1 n = 87	Xeric	n	39	8	0	0	0
		%	83.0	17.0			
Wolf Creek	Hydric	n	35	23	0	0	0
		%	60.3	39.7			
χ^2 = 2.426 P = 0.119 df = 1 n = 96	Xeric	n	19	16	3	0	0
		%	50.0	42.1	7.9		
Grandview	Mesic	n	26	11	2	0	0
		%	66.7	28.2	5.1		
χ^2 = 1.638 P = 0.201 df = 1 n = 82							
Kates Branch	Mesic	n	34	8	1	0	0
		%	79.1	18.6	2.3		
Total		n	334	141	7	0	0
		%	69.3	29.3	1.5		

Table 7. Distribution of straightness, an index of long-term health, for 482 live hemlock trees sampled in November, 1998. The Cochran-Mantel-Haenszel mean-score statistic (χ^2), significance level (P), degrees of freedom (df), and total number of trees (n) are listed for each comparison between moisture gradient classes within each geographic location.

			Hemlock Straightness Class (%) (Straight ← → Leaning)		
Geographic Location	**Moisture-Gradient Class**		**0 to 45**	**> 45 to 90**	**> 90**
Carnifex Ferry State Park χ^2 = 0.786 P = 0.675 df = 2 n = 101	Hydric	n	18	0	1
		%	94.7	0.0	5.3
	Mesic	n	24	1	0
		%	96.0	4.0	
	Xeric	n	51	6	0
		%	89.5	10.5	
Meadow River χ^2 = 3.663 P = 0.160 df = 2 n = 116	Hydric	n	38	2	3
		%	88.4	4.6	7.0
	Mesic	n	53	0	1
		%	98.1		1.9
	Xeric	n	18	1	0
		%	94.7	5.3	
Fayetteville χ^2 = 0.808 P = 0.369 df = 1 n = 87	Hydric	n	37	2	1
		%	92.5	5.0	2.5
	Xeric	n	45	2	0
		%	95.7	4.3	
Wolf Creek χ^2 = 0.589 P = 0.443 df = 1 n = 96	Hydric	n	55	2	1
		%	94.8	3.5	1.7
	Xeric	n	37	1	0
		%	97.4	2.6	
Grandview χ^2 = 4.067 P = 0.044 df = 1 n = 82	Mesic	n	35	3	1
		%	89.7	7.7	2.6
Kates Branch	Mesic	n	43	0	0
		%	100.0		
Total		n	454	20	8
		%	94.2	4.1	1.7

Table 8. Diameter-class distributions for 482 live hemlock trees sampled in November, 1998. The Cochran-Mantel-Haenszel mean-score statistic (χ^2), significance level (P), degrees of freedom (df), and total number of trees (n) are listed for each comparison between moisture gradient classes within each geographic location.

Geographic Location	Moisture-Gradient Class		Hemlock Diameter Class (cm) 8-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85-94	95+
Carnifex Ferry State Park	Hydric	n	4	2	2	0	0	3	2	4	1	1
		%	21.1	10.5	10.5			15.8	10.5	21.1	5.3	5.3
χ^2 = 36.349 P = 0.001 df = 2 n = 101	Mesic	n	6	6	7	3	1	2	0	0	0	0
		%	24.0	24.0	28.0	12.0	4.0	8.0				
	Xeric	n	25	20	10	2	0	0	0	0	0	0
		%	43.9	35.1	17.5	3.5						
Meadow River	Hydric	n	23	9	4	1	0	3	2	1	0	0
		%	53.5	20.9	9.3	2.3		7.0	4.7	2.3		
χ^2 = 2.275 P = 0.321 df = 2 n = 116	Mesic	n	12	15	8	13	6	0	0	0	0	0
		%	22.2	27.8	17.8	24.1	11.1					
	Xeric	n	4	5	5	5	0	0	0	0	0	0
		%	21.1	26.3	26.3	26.3						
Fayetteville	Hydric	n	13	8	8	3	5	3	0	0	0	0
		%	32.5	20.0	20.0	7.5	12.5	7.5				
χ^2 = 0.062 P = 0.803 df = 1 n = 87	Xeric	n	9	19	5	7	2	4	1	0	0	0
		%	19.5	40.4	10.6	14.9	4.3	8.5	2.1			
Wolf Creek	Hydric	n	15	16	18	3	2	4	0	0	0	0
		%	25.9	27.6	31.0	5.2	3.4	6.9				
χ^2 = 0.267 P = 0.605 df = 1 n = 96	Xeric	n	10	9	7	7	5	0	0	0	0	0
		%	26.3	23.7	18.4	18.4	13.2					
Grandview	Mesic	n	17	12	7	3	0	0	0	0	0	0
		%	43.6	30.8	17.9	7.7						
χ^2 = 0.002 P = 0.966 df = 1 n = 82												
Kates Branch	Mesic	n	18	16	6	1	2	0	0	0	0	0
		%	41.9	37.2	13.9	2.3	4.7					
Total		n	156	137	87	48	23	19	5	5	1	1
		%	32.4	28.4	18.0	10.0	4.8	3.9	1.0	1.0	0.2	0.2

Table 9. Diameter-class distributions for 461 live hardwood trees sampled in July, 1999. The Cochran-Mantel-Haenszel mean-score statistic (χ^2), significance level (P), degrees of freedom (df), and total number of trees (n) are listed for each comparison between moisture gradient classes within each geographic location.

Geographic Location	Moisture-Gradient Class		Hardwood Diameter Class (cm) 8-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84
Carnifex Ferry State Park	Hydric	n	12	7	5	0	0	1	0	0
		%	48.0	28.0	20.0			4.0		
χ^2 = 9.246 P = 0.010 df = 2 n = 100	Mesic	n	7	9	9	3	8	2	1	0
		%	17.9	23.1	23.1	7.7	20.5	5.1	2.6	
	Xeric	n	10	10	5	7	2	0	1	1
		%	27.8	27.8	13.9	19.4	5.6		2.8	2.8
Meadow River	Hydric	n	7	18	7	2	2	0	0	0
		%	19.4	50.0	19.4	5.6	5.6			
χ^2 = 2.080 P = 0.353 df = 2 n = 132	Mesic	n	10	7	8	6	1	0	0	0
		%	31.2	21.9	25.0	18.8	3.1			
	Xeric	n	30	11	14	7	2	0	0	0
		%	46.9	17.2	21.9	10.9	3.1			
Fayetteville	Hydric	n	9	24	2	3	1	0	0	0
		%	23.1	61.5	5.1	7.7	2.6			
χ^2 = 11.597 P = 0.001 df = 1 n = 56	Xeric	n	2	6	0	4	2	3	0	0
		%	11.8	35.3		23.5	11.8	17.6		
Wolf Creek	Hydric	n	7	20	10	2	0	0	0	0
		%	18.0	51.3	25.6	5.1				
χ^2 = 9.253 P = 0.002 df = 1 n = 71	Xeric	n	3	9	12	3	2	1	2	0
		%	9.4	28.1	37.5	9.4	6.2	3.1	6.2	
Grandview	Mesic	n	12	11	13	8	6	0	0	0
		%	24.0	22.0	26.0	16.0	12.0			
χ^2 = 0.068 P = 0.795 df = 1 n = 102										
Kates Branch	Mesic	n	11	13	16	9	2	1	0	0
		%	21.1	25.0	30.8	17.3	3.9	1.9		
Total		n	120	145	101	54	28	8	4	1
		%	26.0	31.5	21.9	11.7	6.1	1.7	0.9	0.2

Table 10. Distributions of crown-ratio, the percentage of total tree height with live foliage, for 482 hemlock trees sampled in November, 1998. An asterisk following the diameter-class designation indicates a signifcant (P< 0.05) difference in the distributions of the trees in the moisture-gradient classes at that geographic location, based on the Cochran-Manel-Haenszel mean-score statistic (χ^2).

Geographic Location	Diameter Class	Moisture-Gradient Class	Hemlock Crown-Ratio (%)				
			0-19	20-39	40-59	60-79	80-100
Carnifex Ferry State Park	08-14 *	Hydric	-	-	1	3	-
		Mesic	-	-	1	3	2
		Xeric	1	9	9	3	3
	15-24	Hydric	-	-	1	1	-
		Mesic	-	-	3	3	-
		Xeric	-	2	6	8	4
	25-34	Hydric	-	-	-	1	1
		Mesic	-	-	1	1	5
		Xeric	-	1	2	3	4
	35-44	Hydric	-	-	-	1	2
		Mesic	-	-	-	1	1
	45-54	Mesic	-	-	-	-	1
	55-64	Hydric	-	-	1	1	1
		Mesic	-	-	-	-	2
	65-74	Hydric	-	-	1	1	-
	75-84	Hydric	-	1	2	1	-
	85-94	Hydric	-	-	-	1	-
	95+	Hydric	-	-	-	1	-
Meadow River	08-14	Hydric	1	2	6	9	5
		Mesic	-	3	2	6	1
		Xeric	-	1	-	-	3
	15-24 *	Hydric	-	1	4	3	1
		Mesic	-	4	1	8	2
		Xeric	-	-	-	-	5
	25-34 *	Hydric	-	-	2	2	-
		Mesic	1	2	3	2	-
		Xeric	-	-	-	1	4
	35-44 *	Hydric	-	-	-	-	1
		Mesic	-	1	6	5	1
		Xeric	-	-	-	-	5
	45-54	Mesic	-	-	2	-	4
	55-64	Hydric	-	-	1	1	1
	65-74	Hydric	-	-	1	-	1
	75-84	Hydric	-	1	-	-	-

Table 10. Continued.

Geographic Location	Diameter Class	Moisture-Gradient Class	Hemlock Crown-Ratio (%) 0-19	20-39	40-59	60-79	80-100
Fayetteville	08-14 *	Hydric	-	4	3	4	2
		Xeric	-	1	1	1	6
	15-24	Hydric	-	1	4	3	-
		Xeric	-	6	8	2	3
	25-34	Hydric	-	2	3	2	1
		Xeric	2	1	-	1	1
	35-44	Hydric	-	-	3	-	-
		Xeric	2	2	2	1	-
	45-54	Hydric	-	1	1	3	-
		Xeric	-	1	1	-	-
	55-64	Hydric	-	1	1	1	-
		Xeric	-	1	2	1	-
	65-74	Xeric	-	-	-	-	1
Wolf Creek	08-14	Hydric	2	4	4	3	2
		Xeric	2	2	3	-	3
	15-24 *	Hydric	4	4	7	-	1
		Xeric	-	1	3	1	4
	25-34 *	Hydric	-	7	6	4	1
		Xeric	-	1	1	1	4
	35-44 *	Hydric	-	2	1	-	-
		Xeric	-	-	2	2	3
	45-54 *	Hydric	-	2	-	-	-
		Xeric	-	-	-	-	5
	55-64	Hydric	-	-	4	-	-
Grandview	08-14	Mesic	-	4	5	4	4
Kates Branch		Mesic	-	2	3	7	6
Grandview	15-24	Mesic	-	-	1	5	6
Kates Branch		Mesic	-	-	2	8	6
Grandview	25-34	Mesic	-	-	-	3	4
Kates Branch		Mesic	-	-	-	-	6
Grandview	35-44	Mesic	-	-	1	1	1
Kates Branch		Mesic	-	-	-	-	1
Kates Branch	45-54	Mesic	-	-	-	1	1

Table 11. Cover [a] (%) of structural and dead vegetative components (see Figure 3) sampled in the understory stratum, July, 1999. Means (n= 12) within a row followed by different capital letters were significantly different ($P \leq 0.05$), based on the Waller-Duncan k-ratio t-test.

		Moisture-gradient Class		
Geographic Location	**Cover Attribute**	**Hydric**	**Mesic**	**Xeric**
Carnifex Ferry State Park	Bare ground	0.3	0.3	0.3
	Bare Rock	0.0	0.0	0.5
	Leaf Litter	98.3	98.8	95.3
	Boles	7.3	0.8	2.8
	Stems	9.1 A	2.8 B	5.3 B
	Sticks	22.3	14.8	18.4
	Live Tree Trunks	1.0	0.8	2.1
Meadow River	Bare ground	0.0	0.7	1.3
	Bare Rock	0.5	3.8	4.8
	Leaf Litter	93.2	96.3	95.2
	Boles	2.3	3.4	3.2
	Stems	4.1	3.3	5.2
	Sticks	21.2	32.0	19.3
	Live Tree Trunks	0.0	1.2	0.0
Fayetteville	Bare ground	0.4		0.0
	Bare Rock	0.0		0.0
	Leaf Litter	98.5		98.2
	Boles	2.0		0.7
	Stems	3.6		1.8
	Sticks	22.8		27.9
	Live Tree Trunks	0.5		2.0
Wolf Creek	Bare ground	0.0		0.0
	Bare Rock	0.2		0.0
	Leaf Litter	89.8		98.5
	Boles	0.7 B		2.8 A
	Stems	4.9		1.1
	Sticks	26.0		17.9
	Live Tree Trunks	1.1		1.1

		Geographic Location of Moisture-gradient Class	
		Grandview Mesic	**Kates Branch Mesic**
Grandview and Kates Branch	Bare ground	0.8	0.1
	Bare Rock	0.7	0.0
	Leaf Litter	98.7	96.7
	Boles	2.4	4.4
	Stems	3.8	3.0
	Sticks	10.3	10.7
	Live Tree Trunks	1.5	0.5

[a] Based on percent occurrence at 100 evenly spaced points along each of the four line-transects in each 400 m^2 plot.

Table 12. Density, cover, and frequency of selected species, indexes, and live vegetative components (see Figure 3) sampled at Carnifex Ferry State Park, July, 1999. Means (n= 3 for tree density, n= 12 for all other data) within a row followed by different capital letters were significantly different ($P \leq 0.05$), based on the Waller-Duncan k-ratio t-test.

Growth Form	Species or Group	Moisture-gradient Class		
Attribute	("assigned" cover stratum)	Hydric	Mesic	Xeric
All growth forms				
Frequency [a] (%)	Species Richness	5.6 C	10.3 A	7.7 B
Trees				
Density [b] (400m^2)	Hemlock	6.3 B	8.3 AB	19.0 A
	All other trees	8.3	13.3	12.0
	Species Richness	5.3	7.0	7.3
	Diversity Index	0.61	0.57	0.43
	Dominance Index	2.29	2.16	1.72
Total Cover [c] (%)	Hemlock (canopy)	59.7 A	17.8 B	0.0 B
	Hemlock (subcanopy)	8.4 C	40.0 B	68.0 A
	Hemlock (midstory)	7.6	9.8	13.8
	Hemlock (shrub layer)	1.3	5.6	7.3
	Hemlock (understory)	1.3	0.0	0.1
	Hardwoods (canopy)	0.0 B	78.8 A	76.0 A
	Hardwoods (subcanopy)	17.8	13.9	12.1
	Hardwoods (midstory)	5.2	4.5	5.5
	Hardwoods (shrub layer)	7.2	3.8	0.0
	Hardwoods (understory)	2.3	0.6	0.8
Frequency [a] (%)	All trees	14.2	32.1	27.5
	Hemlock	4.2	0.8	2.1

Table 12. Continued.

Growth Form Attribute	Species or Group ("assigned" cover stratum)	Moisture-gradient Class Hydric	Mesic	Xeric
Saplings, Shrubs and Vines				
Density[d] ($20m^2$)	All species	13.2 A	1.6 B	1.0 B
	Hemlock	2.3 A	0.4 B	0.9 B
	Great Laurel	9.3	0.8	0.0
	Species Richness	2.1	1.0	0.6
	Diversity Index	0.31	0.13	0.00
	Dominance Index	1.46	0.96	0.58
Total Cover[c] (%)	Evergreen shrubs (shrub layer)	47.8 A	5.1 B	0.0 B
	Evergreen shrubs (understory)	49.5 A	7.8 B	0.0 B
	Deciduous shrubs (shrub layer)	0.0	0.0	0.0
	Deciduous shrubs (understory)	0.0	0.1	0.0
Frequency[a] (%)	All shrubs	34.2	15.4	5.8
	Great Laurel	33.3	9.2	0.0
	All vines	1.3 B	31.3 A	27.9 A
Herbaceous				
Total Cover[c] (%)	Bryophytes (understory)	5.5	1.2	4.1
	Ferns (understory)	0.1	4.3	1.0
	Broadleaf herbs (understory)	0.4	2.0	0.4
Frequency[a] (%)	Bryophytes	68.8 A	22.9 B	29.2 B
	Ferns	2.5	20.4	10.4
	Broadleaf herbs	9.6 B	31.3 A	18.8 B
	Grasses/Sedges	0.0	5.4	2.5

[a] Based on percent occurrence in twenty 0.25 m^2 quadrats evenly spaced along each of the four transects in each 400m^2 plot.
[b] Based on number of individuals tallied in each 400m^2 plot.
[c] Based on percent occurrence at 100 evenly spaced points along each of the four line-transects in each 400 m^2 plot.
[d] Based on number of individuals tallied in each of the four 20m^2 belt-transects in each 400 m^2 plot.

Table 13. Density, cover, and frequency of selected species, indexes, and live vegetative components (see Figure 3) sampled at Meadow River, July, 1999. Means (n= 3 for tree density, n= 12 for all other data) within a row followed by different capital letters were significantly different ($P \leq 0.05$), based on the Waller-Duncan k-ratio t-test.

Growth Form	Species or Group	Moisture-gradient Class		
Attribute	("assigned" cover stratum)	Hydric	Mesic	Xeric
All growth forms				
Frequency [a] (%)	Species Richness	4.8 B	7.2 A	5.5 AB
Trees				
Density [b] (400m^2)	Hemlock	14.3 A	18.0 A	6.3 B
	All other trees	12.0 AB	10.7 B	22.3 A
	Species Richness	4.3 B	7.3 AB	9.3 A
	Diversity Index	0.40 B	0.39 B	0.66 A
	Dominance Index	1.82 B	1.62 B	3.78 A
Total Cover [c] (%)	Hemlock (canopy)	58.4	39.1	1.6
	Hemlock (subcanopy)	7.8	43.3	29.5
	Hemlock (midstory)	29.4	11.2	9.8
	Hemlock (shrub layer)	4.5	0.3	0.6
	Hemlock (understory)	1.3	2.0	0.0
	Hardwoods (canopy)	21.5	50.8	74.6
	Hardwoods (subcanopy)	42.8	19.0	45.5
	Hardwoods (midstory)	1.8 B	0.0 B	13.9 A
	Hardwoods (shrub layer)	0.9	2.8	3.2
	Hardwoods (understory)	0.9	1.8	3.1
Frequency [a] (%)	All trees	11.3	13.3	7.5
	Hemlock	2.9 A	0.4 B	0.4 B

Table 13. Continued.

Growth Form Attribute	Species or Group ("assigned" cover stratum)	Moisture-gradient Class Hydric		Mesic		Xeric	
Saplings, Shrubs and Vines							
Density[d] ($20m^2$)	All species	10.9	A	0.9	B	3.8	B
	Hemlock	1.0		0.3		0.1	
	Great Laurel	8.0	A	0.7	B	2.0	B
	Species Richness	2.1	A	0.5	B	2.1	A
	Diversity Index	0.29		0.10		0.51	
	Dominance Index	1.27	B	0.43	C	1.71	A
Total Cover[c] (%)	Evergreen shrubs (shrub layer)	26.0	A	1.9	B	12.3	B
	Evergreen shrubs (understory)	44.3	A	8.3	C	24.8	B
	Deciduous shrubs (shrub layer)	4.0		0.0		0.0	
	Deciduous shrubs (understory)	0.7		0.6		0.0	
Frequency[a] (%)	All shrubs	36.7		20.4		41.3	
	Great Laurel	35.0	A	10.4	B	20.8	B
	All vines	4.2		10.8		18.3	
Herbaceous							
Total Cover[c] (%)	Bryophytes (understory)	16.3		6.1		3.2	
	Ferns (understory)	12.4	A	2.1	B	0.1	B
	Broadleaf herbs (understory)	0.3		0.4		0.0	
Frequency[a] (%)	Bryophytes	72.9		53.3		32.9	
	Ferns	27.9	A	11.7	B	0.0	C
	Broadleaf herbs	2.5		11.3		0.8	
	Grasses/Sedges	0.4		0.0		0.0	

[a] Based on percent occurrence in twenty 0.25 m^2 quadrats evenly spaced along each of the four transects in each 400m^2 plot.
[b] Based on number of individuals tallied in each 400m^2 plot.
[c] Based on percent occurrence at 100 evenly spaced points along each of the four line-transects in each 400 m^2 plot.
[d] Based on number of individuals tallied in each of the four 20m^2 belt-transects in each 400 m^2 plot.

Table 14. Density, cover, and frequency of selected species, indexes, and live vegetative components (see Figure 3) sampled at Fayetteville, July, 1999. Means (n= 3 for tree density, n= 12 for all other data) within a row followed by different capital letters were significantly different ($P \leq 0.05$), based on main-effect F-tests.

Growth Form	Species or Group	Moisture-gradient Class	
Attribute	**("assigned" cover stratum)**	**Hydric**	**Xeric**
All growth forms			
Frequency[a] (%)	Species Richness	8.3	6.8
Trees			
Density[b] (400m^2)	Hemlock	13.3	15.7
	All other trees	13.0	7.3
	Species Richness	6.7	5.0
	Diversity Index	0.50 A	0.36 B
	Dominance Index	1.97 A	1.47 B
Total Cover[c] (%)	Hemlock (canopy)	44.7	56.7
	Hemlock (subcanopy)	35.4	29.9
	Hemlock (midstory)	14.7	11.5
	Hemlock (shrub layer)	7.0	5.9
	Hemlock (understory)	10.4	5.7
	Hardwoods (canopy)	49.2	49.4
	Hardwoods (subcanopy)	14.6	3.3
	Hardwoods (midstory)	1.8	6.1
	Hardwoods (shrub layer)	0.8	0.9
	Hardwoods (understory)	0.8	1.8
Frequency[a] (%)	All trees	24.6	30.4
	Hemlock	10.0	2.9

Table 14. Continued.

Growth Form Attribute	Species or Group ("assigned" cover stratum)	Moisture-gradient Class Hydric	Xeric
Saplings, Shrubs and Vines			
Density [d] ($20m^2$)	All species	8.5 A	1.9 B
	Hemlock	3.3	1.4
	Great Laurel	4.3 A	0.0 B
	Species Richness	2.3	1.0
	Diversity Index	0.34	0.15
	Dominance Index	1.43 A	0.73 B
Total Cover [c] (%)	Evergreen shrubs (shrub layer)	34.3 A	0.0 B
	Evergreen shrubs (understory)	33.8 A	1.3 B
	Deciduous shrubs (shrub layer)	0.0	0.0
	Deciduous shrubs (understory)	0.0	0.0
Frequency [a] (%)	All shrubs	33.3 A	14.2 B
	Great Laurel	19.2	0.4
	All vines	11.7 B	42.9 A
Herbaceous			
Total Cover [c] (%)	Bryophytes (understory)	1.0	0.7
	Ferns (understory)	0.1	0.0
	Broadleaf herbs (understory)	0.4	0.5
Frequency [a] (%)	Bryophytes	23.8	12.5
	Ferns	1.3	0.0
	Broadleaf herbs	25.0	26.7
	Grasses/Sedges	0.0	0.0

[a] Based on percent occurrence in twenty 0.25 m^2 quadrats evenly spaced along each of the four transects in each 400m^2 plot.
[b] Based on number of individuals tallied in each 400m^2 plot.
[c] Based on percent occurrence at 100 evenly spaced points along each of the four line-transects in each 400 m^2 plot.
[d] Based on number of individuals tallied in each of the four 20m^2 belt-transects in each 400 m^2 plot.

Table 15. Density, cover, and frequency of selected species, indexes, and live vegetative components (see Figure 3) sampled at Wolf Creek, July, 1999. Means (n= 3 for tree density, n= 12 for all other data) within a row followed by different capital letters were significantly different ($P \leq 0.05$), based on main-effect F-tests.

Growth Form	Species or Group	Moisture-gradient Class	
Attribute	("assigned" cover stratum)	Hydric	Xeric
All growth forms			
Frequency[a] (%)	Species Richness	2.8 B	9.2 A
Trees			
Density[b] (400m^2)	Hemlock	19.3	12.7
	All other trees	13.0	10.7
	Species Richness	6.7	6.3
	Diversity Index	0.41	0.53
	Dominance Index	1.89	2.00
Total Cover[c] (%)	Hemlock (canopy)	45.3	28.8
	Hemlock (subcanopy)	41.1	33.3
	Hemlock (midstory)	12.6 B	16.2 A
	Hemlock (shrub layer)	0.0	13.8
	Hemlock (understory)	0.6 A	0.3 B
	Hardwoods (canopy)	44.8	75.2
	Hardwoods (subcanopy)	13.6	9.1
	Hardwoods (midstory)	4.8	12.0
	Hardwoods (shrub layer)	0.0	2.0
	Hardwoods (understory)	0.2	4.6
Frequency[a] (%)	All trees	1.3	32.5
	Hemlock	0.4	1.3

Table 15. Continued.

Growth Form Attribute	Species or Group ("assigned" cover stratum)	Moisture-gradient Class Hydric	Xeric
Saplings, Shrubs and Vines			
Density[d] ($20m^2$)	All species	9.2 A	3.5 B
	Hemlock	0.4	1.8
	Great Laurel	8.3 A	0.2 B
	Species Richness	1.5	1.4
	Diversity Index	0.11	0.20
	Dominance Index	1.14	1.03
Total Cover[c] (%)	Evergreen shrubs (shrub layer)	32.0 A	2.5 B
	Evergreen shrubs (understory)	51.8 A	1.6 B
	Deciduous shrubs (shrub layer)	0.0	0.3
	Deciduous shrubs (understory)	0.0	0.8
Frequency[a] (%)	All shrubs	31.3	20.4
	Great Laurel	30.4 A	1.6 B
	All vines	0.8 B	16.7 A
Herbaceous			
Total Cover[c] (%)	Bryophytes (understory)	2.0	0.3
	Ferns (understory)	0.1	0.1
	Broadleaf herbs (understory)	0.0	0.8
Frequency[a] (%)	Bryophytes	22.5 A	4.2 B
	Ferns	0.4	1.3
	Broadleaf herbs	1.7	29.2
	Grasses/Sedges	0.0	0.0

[a] Based on percent occurrence in twenty 0.25 m^2 quadrats evenly spaced along each of the four transects in each 400m^2 plot.
[b] Based on number of individuals tallied in each 400m^2 plot.
[c] Based on percent occurrence at 100 evenly spaced points along each of the four line-transects in each 400 m^2 plot.
[d] Based on number of individuals tallied in each of the four 20m^2 belt-transects in each 400 m^2 plot.

Table 16. Density, cover, and frequency of selected species, indexes, and live vegetative components (see Figure 3) sampled at Grandview and Kates Branch, July, 1999. Means (n= 3 for tree density, n= 12 for all other data) within a row followed by different capital letters were significantly different ($P \leq 0.05$), based on main-effect F-tests.

Growth Form	Species or Group	Moisture-gradient Class	
Attribute	("assigned" cover stratum)	Grandview Mesic	Kates Branch Mesic
All growth forms			
Frequency [a] (%)	Species Richness	10.8 A	8.0 B
Trees			
Density [b] (400m^2)	Hemlock	13.0	14.3
	All other trees	17.7	17.7
	Species Richness	5.7	8.3
	Diversity Index	0.49	0.53
	Dominance Index	2.53	2.33
Total Cover [c] (%)	Hemlock (canopy)	0.0 B	7.3 A
	Hemlock (subcanopy)	55.0	62.3
	Hemlock (midstory)	17.6	14.4
	Hemlock (shrub layer)	0.6	6.7
	Hemlock (understory)	0.0	2.8
	Hardwoods (canopy)	71.0	71.5
	Hardwoods (subcanopy)	29.5	29.4
	Hardwoods (midstory)	0.0	8.0
	Hardwoods (shrub layer)	2.1	2.3
	Hardwoods (understory)	2.1	0.6
Frequency [a] (%)	All trees	32.5	48.3
	Hemlock	0.0	2.9

Table 16. Continued.

Growth Form Attribute	Species or Group ("assigned" cover stratum)	Moisture-gradient Class Grandview Mesic	Kates Branch Mesic
Saplings, Shrubs and Vines			
Density[d] ($20m^2$)	All species	0.9	3.5
	Hemlock	0.5	1.1
	Great Laurel	0.3	0.0
	Species Richness	0.8	1.4
	Diversity Index	0.13	0.17
	Dominance Index	0.75	0.90
Total Cover[c] (%)	Evergreen shrubs (shrub layer)	16.7	3.6
	Evergreen shrubs (understory)	0.2	0.4
	Deciduous shrubs (shrub layer)	0.0	0.5
	Deciduous shrubs (understory)	0.8	0.1
Frequency[a] (%)	All shrubs	8.8	6.7
	Great Laurel	1.7	0.0
	All vines	17.5	8.8
Herbaceous			
Total Cover[c] (%)	Bryophytes (understory)	1.6	1.3
	Ferns (understory)	1.8	1.3
	Broadleaf herbs (understory)	1.7	0.8
Frequency[a] (%)	Bryophytes	20.4	20.8
	Ferns	13.3	12.9
	Broadleaf herbs	32.1	32.1
	Grasses/Sedges	0.4	2.1

[a] Based on percent occurrence in twenty $0.25\ m^2$ quadrats evenly spaced along each of the four transects in each $400m^2$ plot.
[b] Based on number of individuals tallied in each $400m^2$ plot.
[c] Based on percent occurrence at 100 evenly spaced points along each of the four line-transects in each $400\ m^2$ plot.
[d] Based on number of individuals tallied in each of the four $20m^2$ belt-transects in each $400\ m^2$ plot.

Table 17. Statistical Analysis System (SAS) programming statements used for contingency table analyses of the baseline data, and suggested SAS programming statements for analysis of future, multi-year data sets. Response variables (and abbreviations in programming statements) were crown-vigor (vigor), straightness (lean), diameter class (dclass), and crown ratio (c_ratio). Baseline data were analyzed separately at each geographic location (geoloc). The data in Table 10 also were separated by diameter class (dclass). Baseline data mean-score comparisons were among moisture-gradient classes (trtmt). Multi-year mean-score comparisons would be between years, by controlling for trtmt at each geoloc (1), and/or by analyzing the data separately for each trtmt (2).

Baseline Data Table of Results	**SAS Programming Statements**	
	Baseline Data Analysis	**Multi-year Analysis**
Table 6	proc freq; by geoloc; tables trtmt* vigor / cmh nocol nopct;	(1) proc freq; by geoloc; table trtmt* year* vigor / cmh nocol nopct; (2) proc freq; by geoloc trtmt; tables year* vigor / cmh nocol nopct;
Table 7	proc freq; by geoloc; tables trtmt* lean / cmh nocol nopct;	(1) proc freq; by geoloc; tables trtmt* year* lean / cmh nocol nopct; (2) proc freq; by geoloc trtmt; tables year* lean / cmh nocol nopct;
Tables 8 and 9	proc freq; by geoloc; tables trtmt* dclass / cmh nocol nopct;	(1) proc freq; by geoloc; tables trtmt* year* dclass / cmh nocol nopct; (2) proc freq; by geoloc trtmt; tables year* dclass / cmh nocol nopct;
Table 10	proc freq; by geoloc dclass; tables trtmt* c_ratio / cmh nocol nopct;	(1) proc freq; by geoloc dclass; tables trtmt* year* c_ratio / cmh nocol nopct; (2) proc freq; by geoloc dclass trtmt; tables year* c_ratio / cmh nocol nopct;

Table 18. Statistical Analysis System (SAS) programming statements associated with the Analysis of Variance (ANOVA) of baseline data reported in Tables 11-16, and suggested SAS programming statements for analysis of future, multi-year data sets. Response variables (and abbreviations in programming statements) were density (den), crown ratio (c_ratio), total cover (cov), and frequency (freq). Independent variables included moisture-gradient class (trtmt), plot, diameter class (dclass), transect (tran), and year. Transect was the only random effect. All other independent variables were treated as fixed effects. The sample sizes (n) listed in the footnotes, which are for main-effect (i.e., trtmt) mean comparisons, would double with two years of data. Data were analyzed separately at each geographic location (geoloc). Comparisons of crown ratio trtmt means are not shown in Tables 11-16, but are reported in the text.

Growth Form (Attribute)	**SAS Programming Statements**	
	Baseline Data Analysis	**Multi-year Analysis**
Trees (Density) [a]	proc glm; classes trtmt; by geoloc; model den = trtmt; means trtmt / waller; run; quit;	proc glm; classes trtmt year; by geoloc; model den = trtmt year year*trtmt; means trtmt / waller; lsmeans year*trtmt / stderr pdiff; run; quit;

Saplings and Shrubs (Density) [b]	proc glm; classes trtmt plot; by geoloc;
	model den = trtmt plot(trtmt) tran(plot trtmt);
	test h= trtmt e= tran (plot trtmt);
	means trtmt / waller;
	means trtmt / waller e= tran (plot trtmt);
	run; quit;
		proc glm; classes trtmt plot year; by geoloc;
		model den = trtmt plot(trtmt) tran(plot trtmt)
		year year*trtmt;
		test h= trtmt e= tran (plot trtmt);
		means trtmt / waller;
		means trtmt / waller e= tran (plot trtmt);
		lsmeans year*trtmt / stderr pdiff;
		run; quit;

Trees (Crown Ratio) [c]	proc glm; classes trtmt plot dclass; by geoloc; model c_ratio = trtmt plot(trtmt) dclass(plot trtmt); means trtmt / waller; means trtmt / tukey; run; quit;	proc glm; classes trtmt plot dclass year; by geoloc; model c_ratio = trtmt plot(trtmt) dclass(plot trtmt) year year*trtmt; means trtmt / waller; means trtmt / tukey; lsmeans year*trtmt / stderr pdiff; run; quit;

All Growth Forms (Cover) [d]	proc glm; classes trtmt plot; by geoloc;
	model cov = trtmt plot(trtmt) tran(plot trtmt);
	test h= trtmt e= tran (plot trtmt);
	means trtmt / waller;
	means trtmt / waller e= tran (plot trtmt);
	run; quit;
		proc glm; classes trtmt plot year; by geoloc;
		model cov = trtmt plot(trtmt) tran(plot trtmt)
		year year*trtmt;
		test h= trtmt e= tran (plot trtmt);
		means trtmt / waller;
		means trtmt / waller e= tran (plot trtmt);
		lsmeans year*trtmt / stderr pdiff;
		run; quit;

All Growth Forms (Frequency) [e]	proc glm; classes trtmt plot; by geoloc;
	model freq = trtmt plot(trtmt) tran(plot trtmt);
	test h= trtmt e= tran (plot trtmt);
	means trtmt / waller;
	means trtmt / waller e= tran (plot trtmt);
	run; quit;
		proc glm; classes trtmt plot year; by geoloc;
		model freq = trtmt plot(trtmt) tran(plot trtmt)
		year year*trtmt;
		test h= trtmt e= tran (plot trtmt);
		means trtmt / waller;
		means trtmt / waller e= tran (plot trtmt);
		lsmeans year*trtmt / stderr pdiff;
		run; quit;

[a] Includes comparisons of plot ($400\ m^2$) Species Richness, Diversity Index, Dominance Index, and density means (n= 3 plots per trtmt).
[b] Includes comparisons of belt-transect ($20\ m^2$) Species Richness, Diversity Index, Dominance Index, and density means (n= 12 [3 plots x 4 transects] per trtmt).
[c] Based on moisture-gradient mean comparisons of hemlock trees (n = total number of trees in all 3 plots in each trtmt).
[d] Includes comparisons of total cover line-transect means in the "assigned" stratum (n= 12 [3 plots x 4 transects] per trtmt).
[e] Includes mean comparisons based on 20 quadrats ($0.25\ m^2$) sampled along each transect (n= 12 [3 plots x 4 transects] per trtmt).

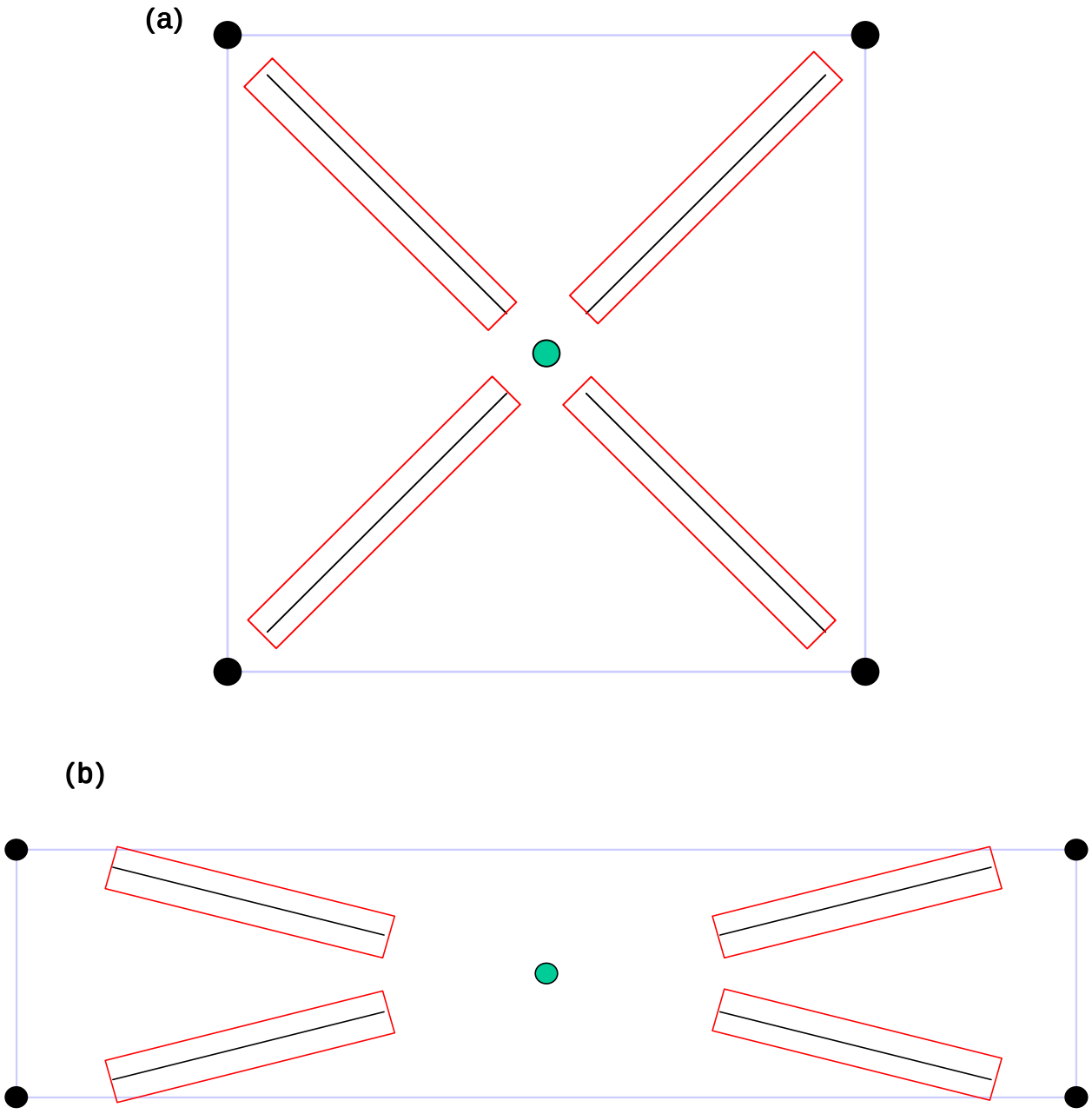

Figure 2. Schematic representation of (a) 20x20m and (b) 10x40m hemlock plots. The green circle at the center represents the center-stake. The four black lines represent the four 10m line-transects radiating from the center-stake toward each corner stake (black circles). The red rectangles represent the four 2 x10m belt-transects. The light-blue line represents the perimeter of the plot. Unless noted in Table 2, both the line-transects and belt-transects begin 1m from the center-stake in 20x20m plots and 5m from the center-stake in 10x40m plots.

Vegetation Strata	Supercanopy Canopy Subcanopy High Midstory Low Midstory Shrub Layer Uprooted Trees Understory
Live Vegetative Components	Hemlock trees Hardwood trees Pine trees Vines Evergreen shrubs Deciduous shrubs Clubmosses Bryophytes Ferns Broadleaf Herbs Grasses/Sedges
Dead Vegetative Components	Boles (trunks of trees) Stems (branches >1 inch diameter) Sticks (branches · 1 inch diameter) Leaf Litter
Structural Components	Bare Ground Bare Rock Live Tree Trunks

Figure 3. Cover components measured on line-transects and the vegetation strata where they would be expected to occur. For example, "Hemlock Trees" would be expected to occur in all vegetation strata, whereas "Leaf Litter" only would be expected to occur in the Understory stratum. The Uprooted Trees stratum would be expected to overlap with several of the lower strata.

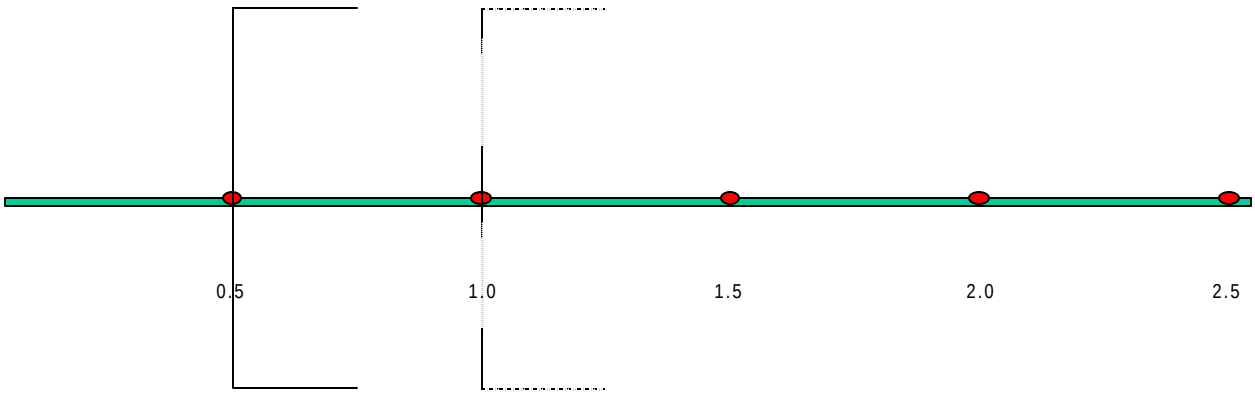

Figure 4. Example of proper placement of open-ended 0.25m quadrat (solid black lines) at the first of 20 sampling points along a 10-m section of nylon tape. The quadrat is then moved to the 1.0-m mark (dashed black lines) on the nylon tape to measure the second sampling point , etc., up to the 10.0-m mark. By maintaining the orientation of the 0.25m quadrat as shown, each sampling points is spaced 0.25m away from the previous point. The quadrat is open-ended, meaning that it only has three sides, so that it can be maneuvered around trees and shrubs. The center of the long side of the quadrat frame should be marked in order to properly position it over the sampling point on the nylon tape.

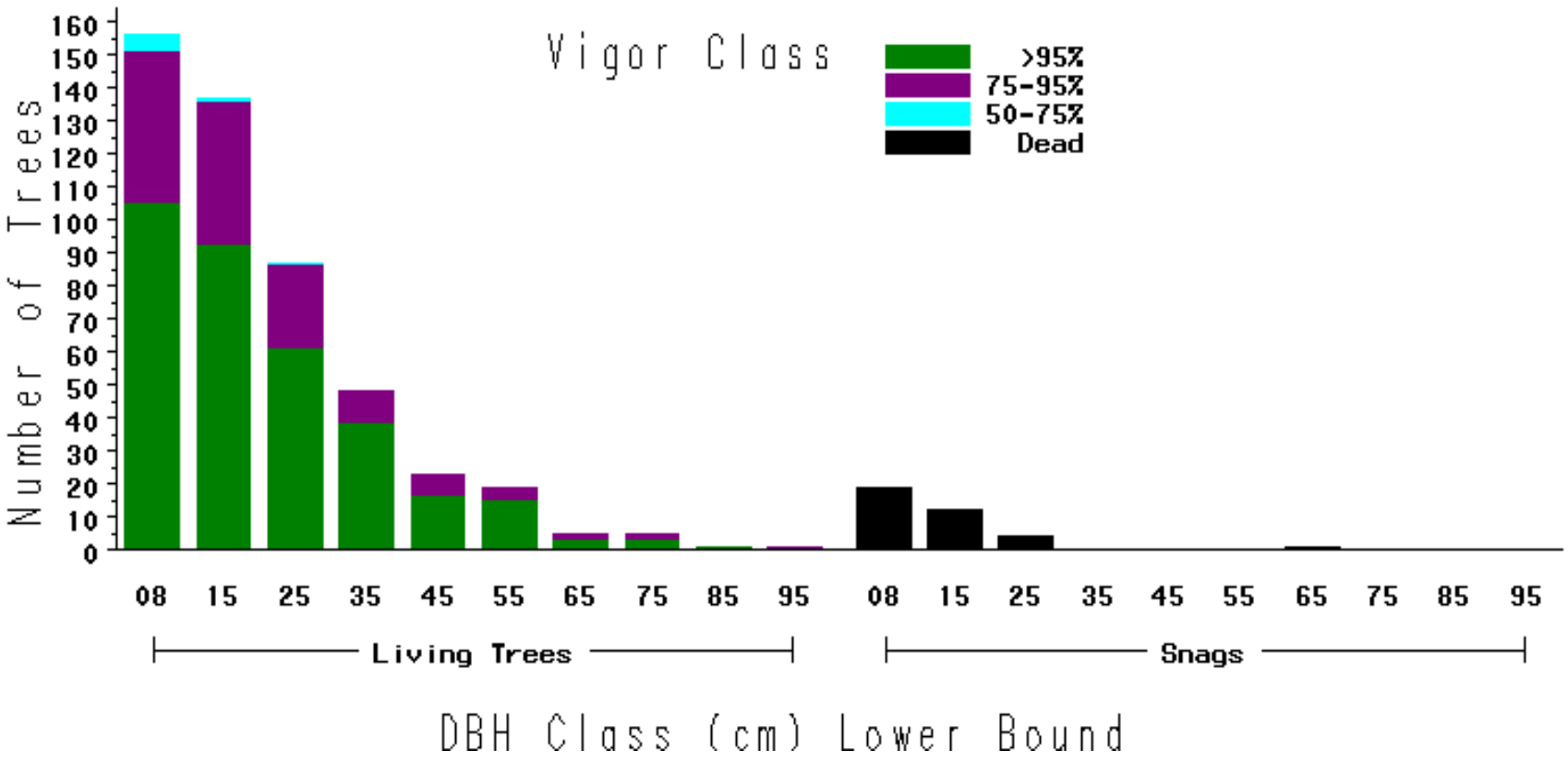

Figure 5. Distribution of live and dead hemlock trees, by diameter class, and crown-vigor of all 518 hemlock trees sampled on all 36 hemlock ecosystem monitoring plots, November, 1998.

NEW RIVER NORTH

Fayetteville (Fayetteville Quadrangle): 3 Hydric Plots at Fern Creek

FH1.	Plot dimensions (m):	10 x 40
	Perimeter angles:	35/ and 125/ (from magnetic north)
	Plot aspect/slope (scale):	none / Flat (0), undulating
	Photo corner:	200/ (from magnetic north)
	UTM coordinates:	17 4 948 04 / S 42 124 20 (4/19/99, 3:45PM)

Creek-left, 10m north of rock-circle/firepit, between the old trail and the creek. Note that the stake on NE corner is on a small knoll, 12.5m from the NW corner-stake. When sampling, it is necessary to temporarily move the NE corner 2.5m closer to the NW corner-stake. This will put the NE corner of the plot in the center of a low swale, which may be flooded during wet seasons.

FH2.	Plot dimensions (m):	20 x 20
	Perimeter angles:	232/ and 322/ (from magnetic north)
	Plot aspect/slope (scale):	none / Flat (0), undulating surface
	Photo corner:	210/ (from magnetic north)
	UTM coordinates:	17 4 949 72 / S 42 124 51 (4/19/99, 3:00PM)

Creek-right, about 50m west (260/) of new trailhead parking lot, and about 25m downstream of two large-dbh flagged hemlocks that are marking a new survey boundary-line. Several mature, forked hemlock trees in the plot.

FH3.	Plot dimensions (m):	20 x 20
	Perimeter angles:	156/ and 246/ (from magnetic north)
	Plot aspect/slope (scale):	Southwest-facing / Moderate (2), undulating
	Photo corner:	200/ (from magnetic north)
	UTM coordinates:	17 4 950 46 / S 42 124 29 (4/19/99, 2:15PM)

Not on Fern Creek, but up the side-drainage that parallels route 82, on creek-right side (i.e., the road-side of the creek). There is a rock sprayed with an orange circle about 65m southeast of the route 82 bridge that crosses Fern Creek. Follow the deer trail just north of the orange circle for 50m at 190/ to the large-dbh hemlock with orange circle on trunk. Then go about 75m at 210/ to find the plot. The NW corner-stake is at the base of a 40cm dbh hemlock at the edge of the creek. The SW corner-stake is behind a coppiced red maple, under rhododendrons. The other corners are upslope from the creek.

Fayetteville (Fayetteville Quadrangle): 3 Xeric Plots at Burnwood/Ames Heights -- no flagging used.

FX1.	Plot dimensions (m):	20 x 20
	Perimeter angles:	8/ and 98/ (from magnetic north)
	Plot aspect/slope (scale):	South-facing / Moderately steep (3)
	Photo corner:	145/ (from magnetic north)
	UTM coordinates:	17 4 931 54 / S 42 136 82 (4/18/99, 4:30PM)

Look for orange circle on a rock that is near the edge of the woods, about 50m southwest of the hexagonal picnic shelter. The plot is about 50m south of the orange circle.

FX2.	Plot dimensions (m):	20 x 20
	Perimeter angles:	90/ and 180/ (from magnetic north)
	Plot aspect/slope (scale):	South-facing / Flat (0)
	Photo corner:	40/ (from magnetic north)
	UTM coordinates:	17 4 933 60 / S 42 141 20 (4/18/99, 3:00PM)

Park at the old house with helicopter landing site on the top of the hill at junction of Route 19 and Ames Heights Road. Follow the mowed trail west across the old field. Turn left off of the trail immediately after entering the woods at the white double-blaze trail marker on tree. The plot is about 75m SE of the double-blaze.

FX3.	Plot dimensions (m):	20 x 20
	Perimeter angles:	45/ and 135/ (from magnetic north)
	Plot aspect/slope (scale):	West-facing / Moderately steep (3)
	Photo corner:	180/ (from magnetic north)
	UTM coordinates:	17 4 930 70 / S 42 142 29 (4/18/99, 3:45PM)

Follow the main trail from the double-blaze out to the WSW point of the plateau. About 75m from the point, take the smaller fork in the trail straight out to the edge of the steep dropoff (the main trail veers off to the right).

Wolf Creek (Fayetteville Quadrangle): 3 Hydric Plots and 3 Xeric Plots

Enter Huse Memorial Cemetary, follow the one-way road to the farthest SE corner, and park beside the piles of sand and mulch behind the stone wall. Go down the south-facing slope about 75m to the creek-left trail that parallels House Branch.

WH1.	Plot dimensions (m):	10 x 40
	Perimeter angles:	230/ and 320/ (from magnetic north)
	Plot aspect/slope (scale):	SSE-facing / Moderate (2)
	Photo corner:	45/ (from magnetic north)
	UTM coordinates:	17 4 920 24 / S 42 115 59 (4/17/99, 4:45PM)

Follow the trail downstream, about 50m past the first right fork in trail, to the 14cm dbh hemlock with orange circle on the north side of the trail. The plot is on the south side of the trail, creek-left, between the trail and House Branch, very close to both the trail (10m) and the creek (5m).

WX1.	Plot dimensions (m):	20 x 20
	Perimeter angles:	154/ and 244/ (from magnetic north)
	Plot aspect/slope (scale):	West-facing / Moderate (2)
	Photo corner:	200/ (from magnetic north)
	UTM coordinates:	17 4 920 96 / S 42 113 03 (4/17/99, 1:00PM)

The plot is on the other side of House Branch near the narrow, northern point of the ridgetop, on the west-facing slope.

WX2.	Plot dimensions (m):	20 x 20
	Perimeter angles:	180/ and 270/ (from magnetic north)
	Plot aspect/slope (scale):	Northeast-facing / Slight (1) to Moderate (2)
	Photo corner:	305/ (from magnetic north)
	UTM coordinates:	17 4 922 19 / S 42 111 79 (4/17/99, 1:30PM)

From Plot X1, follow the contour of the ridgetop above the creek-left side of Wolf Creek southeast for about 300m to the patch of hemlocks on the edge of the slope.

WH2.	Plot dimensions (m):	20 x 20
	Perimeter angles:	230/ and 320/ (from magnetic north)
	Plot aspect/slope (scale):	Northeast-facing / Moderate (2), undulating
	Photo corner:	225/ (from magnetic north) -- Photos taken half-way between uphill corner-stakes
	UTM coordinates:	17 4 922 31 / S 42 113 30 (4/17/99, 4:00PM)

From Plot X2, go about 250m down slope at 350/. The plot is about 20m northeast (down and to the left) of a big broken hemlock (about 70cm diameter and 5m left standing).

WX3.	Plot dimensions (m):	20 x 20
	Perimeter angles:	256/ and 346/ (from magnetic north)
	Plot aspect/slope (scale):	East-facing / Flat (0) to Moderate (2)
	Photo corner:	300/ (from magnetic north)
	UTM coordinates:	17 4 924 81 / S 42 110 16 (4/17/99, 2:15PM)

From X2, go about 250m at 150/, proceeding down off the ridge into a drainage, then back up to a spur of the ridge to the hemlocks on the SE side of the spur.

WH3.	Plot dimensions (m):	20 x 20
	Perimeter angles:	154/ and 244/ (from magnetic north)
	Plot aspect/slope (scale):	ENE-facing / Slight (1) to Steep (4)
	Photo corner:	300/ (from magnetic north)
	UTM coordinates:	17 4 925 84 / S 42 111 23 (4/17/99, 3:00PM)

From X3, go about 225m down slope at 60/. The plot is on the north side of a point where a small drainage spills into Wolf Creek. Three of the four corner-stakes are down off the sides of a 2-3m ledge.

NEW RIVER SOUTH

Kates Branch (Prince Quadrangle): 3 Mesic Plots -- no flagging used.

Take the Bragg Exit off I-64. Go north about 1/2 mile, and turn left onto Cloverdale Road. Proceed to the last curve before crossing over I-64 on a overpass-bridge. Follow steep gravel road NW of corner in road down to a red metal gate. Beyond the gate, you cross Mr. Redden's private property (permission/access agreement set up by Frank Sellers, NPS law enforcement, Grandview Stn. 763-4828). Follow the winding jeep trail past the gate generally north to the NSP border sign on a 3m-tall post at the fork in the jeep trail. Take the left fork, going generally west. Just past the old homestead/clearing, you will intersect the SE corner of the Kates Plateau Trail. Distance from red gate to here is about 1 mile. Keep going straight (roughly west) along the white-blazed KP Trail to where it gradually drops down into the wetland basin along Kates Branch. Where the KP Trail meets the floor of the basin, look for a 1m-square rock sticking in the Trail with an orange circle. From this rock, go another 300m further along the Trail to a 27cm dhb white oak with an orange circle sprayed about 2m above ground. This oak is about 10m off the north side of the Trail and is purposely difficult to spot. Plot M1 is on the opposite side of the Trail, adjacent to the marsh.

KM1.	Plot dimensions (m):	20 x 20
	Perimeter angles:	0/ and 90/ (from magnetic north)
	Plot aspect/slope (scale):	none / Flat (0)
	Photo corner:	130/ (from magnetic north)
	UTM coordinates:	17 4 988 21 / S 41 799 66 (4/20/99, 8:00AM)

The plot is between two small drainages that cross the KP Trail, between the Trail and the wetland, about 10m off the Trail.

KM2.	Plot dimensions (m):	20 x 20
	Perimeter angles:	136/ and 226/ (from magnetic north)
	Plot aspect/slope (scale):	none / Flat (0)
	Photo corner:	180/ (from magnetic north)
	UTM coordinates:	17 4 985 65 / S 41 799 53 (4/20/99, 8:30AM)

From M1, go about 300m further along the Trail. Look for the 24cm dbh white oak with orange circle, behind some 2m-tall hemlocks about 10m off the north side of the Trail. The Plot is on the opposite side of the Trail, between the Trail and the wetland, about 10m off the Trail.

KM3.	Plot dimensions (m):	20 x 20
	Perimeter angles:	173/ and 263/ (from magnetic north)
	Plot aspect/slope (scale):	South-facing / Slight (1)
	Photo corner:	130/ (from magnetic north)
	UTM coordinates:	17 4 983 67 / S 41 801 61 (4/20/99, 9:00AM)

From M2, go about 275m further along Trail. Look for a 15cm dbh red maple about 5m off the south (wetland) side of the Trail, with an orange circle. The maple is about 60m past a small drainage crossing the Trail. The Plot is on the opposite (north) side, about 10m east of the Trail.

Grandview (Prince Quadrangle): 3 Mesic Plots -- no flagging used.

GM1.	Plot dimensions (m):	20 x 20
	Perimeter angles:	38/ and 128/ (from magnetic north)
	Plot aspect/slope (scale):	NNW- to SSE-facing / Flat (0) to Moderate (2)
	Photo corner:	175/ (from magnetic north)
	UTM coordinates:	17 4 933 69 / S 41 870 72 (4/20/99, 10:30AM)

Follow paved roads to shelter #2 parking area. Take the left fork at the Big Buck Trailhead sign. Look for 14cm dbh white oak with an orange circle sprayed down low on the trunk about 100m down the trail on the left (south) side. Go SSW (225/) from this oak, down slope to the 15cm dbh beech with orange circle on edge of old jeep trail. The Plot is below the jeep trail, in the creekbed. The center-stake is on the creek-left side, but two of the corner-stakes are on the creek-right side. The plot is in a deep hollow, which accounts for the strange (NNW- to SSE-facing) aspect.

GM2.	Plot dimensions (m):	20 x 20
	Perimeter angles:	90/ and 180/ (from magnetic north)
	Plot aspect/slope (scale):	North-facing / Moderate (2)
	Photo corner:	45/ (from magnetic north)
	UTM coordinates:	17 4 939 62 / S 41 877 91 (4/20/99, 11:15AM)

Starting at the "T" intersection, drive 0.375 miles north along the Turkey Spur Road. The "T" is just east of the fork in the road that goes to Shelters #2 and #3. The plot is about 100m west (270/) of the pull-off point on the road. The center-stake is at the base of a large, white pine.

GM3.	Plot dimensions (m):	20 x 20
	Perimeter angles:	90/ and 180/ (from magnetic north)
	Plot aspect/slope (scale):	North-facing / Moderate (2)
	Photo corner:	50/ (from magnetic north)
	UTM coordinates:	17 4 941 83 / S 41 883 29 (4/20/99, 12:00PM)

0.425 miles north of pull-off for Plot M2 on Turkey Spur Road. This plot is about 100m NW of this pull-off. The center-stake is at the base of a 35cm dbh hemlock.

MEADOW-GAULEY RIVERS

Meadow River, Hedricks Creek (Summersville Dam Quadrangle): 3 Hydric Plots

Follow Arrowwood Creek Road 1.4 miles north from junction with Route 19 to gravel road on right. Follow gravel road east about 1 mile to edge of inner gorge. Recommend walking from here down to the river (about a 10-minute walk).

MH1.	Plot dimensions (m):	20 x 20
	Perimeter angles:	155/ and 245/ (from magnetic north)
	Plot aspect/slope (scale):	North-facing / Moderate (2), undulating
	Photo corner:	10/ (from magnetic north)
	UTM coordinates:	17 5 050 50 / S 42 226 33 (4/18/99, 12:45AM)

Beside Hedricks Creek, creek-right side, about 150m upstream from Meadow River. Go about 75m upstream of the 36-inch dbh hemlock on top of the house-size boulder to another house-sized boulder. Go under the NE side of this boulder then straight about another 50m to a relatively flat spot about 75m from the creek.

MH2.	Plot dimensions (m):	20 x 20
	Perimeter angles:	124/ and 214/ (from magnetic north)
	Plot aspect/slope (scale):	North-facing / Steep (4), undulating
	Photo corner:	330/ (from magnetic north)
	UTM coordinates:	17 5 054 10 / S 42 224 71 (4/18/99, 12:00PM)

From wooden bridge crossing Hedricks Creek, follow gravel railroad grade southeast for 250m to the orange circle on a rock on the Meadow River side of the RR grade. Climb the rocky deer trail leading up into the woods. Continue to follow the deer trail up slope to a basswood coppice about 50m below the cliff face. The center of the plot is about 30m SW of the basswood coppice between several large-dbh hemlocks. Flags on 30cm dbh red maple marking center-stake.

MH3.	Plot dimensions (m):	20 x 20
	Perimeter angles:	138/ and 228/ (from magnetic north)
	Plot aspect/slope (scale):	NNE-facing / Moderately steep (3), undulating
	Photo corner:	290/ (from magnetic north)
	UTM coordinates:	17 5 056 93 / S 42 223 94 (4/18/99, 11:15AM)

From orange rock marking deer trail to H2, go another 250m southeast along RR grade to an orange circle on a rock in a large pile of rocks on the Meadow River side of the RR grade. The Plot is about 50m into the woods opposite the rock pile, a double-flagged *Betula lenta* marking the center-stake.

Meadow River, Mt. Lookout Road (Summersville Dam Quadrangle): 3 Mesic Plots

Follow Mt. Lookout Road all the way into where it turns into a jeep trail and starts descending into the gorge. Continue down to the grave site beside the house-sized boulder and the unnamed creek that crosses the jeep trail.

MM1.	Plot dimensions (m):	20 x 20
	Perimeter angles:	45/ and 135/ (from magnetic north)
	Plot aspect/slope (scale):	West-facing / Slight (1)
	Photo corner:	2/ (from magnetic north)
	UTM coordinates:	17 5 055 40 / S 42 257 97 (4/17/99, 9:30AM)

Look for orange circle along the south side of the jeep trail on a rock, about 50m further down slope from the grave site. The plot is about 15m off the north side of the jeep trail in a rocky area. This plot appears that it may be wetter that M2 and M3 due to its proximity to the creek.

MM2.	Plot dimensions (m):	20 x 20
	Perimeter angles:	245/ and 335/ (from magnetic north)
	Plot aspect/slope (scale):	West-facing / Moderate (2)
	Photo corner:	230/ (from magnetic north)
	UTM coordinates:	17 5 053 30 / S 42 259 76 (4/17/99, 10:30AM)

From M1, continue generally NW down jeep trail for 250m to a steeper, secondary jeep trail on the left. Go left (west) on the steeper jeep trail about 60m down to the orange circle on a rock that is on the right side of the trail. The plot is about 30m off the left (south) side of the trail, opposite to the orange rock.

MM3.	Plot dimensions (m):	20 x 20
	Perimeter angles:	88/ and 178/ (from magnetic north)
	Plot aspect/slope (scale):	South-facing / Steep (4)
	Photo corner:	140/ (from magnetic north)
	UTM coordinates:	17 5 050 78 / S 42 261 83 (4/17/99, 11:15AM)

From M2, continue generally NW down the main jeep trail about 250m to an ascending right-hand fork. Look for the orange rock at this fork. Go up this fork about 50m to orange circle on a rock that is off to the right (uphill) side. The plot is about 30m up slope from the orange rock.

Meadow River, Underwood Road (Summersville Dam Quadrangle): 3 Xeric Plots

From junction with Route 19, just north of the Meadow River bridge, go 0.2 miles W on Underwood Road to the first right-hand curve in the road. The jeep trail to the plots begins at this curve, off of the left (south) side of the road.

MX1.	Plot dimensions (m):	20 x 20
	Perimeter angles:	118/ and 208/ (from magnetic north)
	Plot aspect/slope (scale):	SSW-facing / Steep (4)
	Photo corner:	90/ (from magnetic north)
	UTM coordinates:	17 5 057 08 / S 42 225 90 (4/18/99, 7:45AM)

Follow the jeep trail generally W for about 1 mile, gradually descending to the Meadow River (do not take the steep jeep trail that forks left about 500m from parking area). Look for the orange rock at the base of a steep slope on the right (north) side of trail, about 100m before (east of where) this trail joins the jeep trail that parallels the edge of the river. Two rocks near center-stake are sprayed orange.

MX2.	Plot dimensions (m):	10 x 40
	Perimeter angles:	142/ and 232/ (from magnetic north)
	Plot aspect/slope (scale):	West-facing / Moderate (2), undulating
	Photo corner:	145/ (from magnetic north)
	UTM coordinates:	17 5 053 37 / S 42 227 66 (4/18/99, 8:30AM)

From X1, descend 100m to the jeep trail that parallels the edge of the river, continue generally W about another 200m to a fork. Take the right fork, and begin to ascend gradually. Go about 50m from the fork to an orange circle on a rock on the right side of the trail. The center stake is about 5m behind the orange rock.

MX3.	Plot dimensions (m):	20 x 20
	Perimeter angles:	0/ and 90/ (from magnetic north)
	Plot aspect/slope (scale):	Southwest-facing / Slight (1) to Steep (4)
	Photo corner:	45/ (from magnetic north)
	UTM coordinates:	17 5 051 89 / S 42 229 64 (4/18/99, 9:30AM)

From X2, continue to go up the jeep trail about 250m to the orange rock off of the left (south) side of the trail. The center-stake is about 2m behind the orange rock.

Carnifex Ferry Battlefield State Park (Summersville Dam Quadrangle):
3 Hydric, 3 Mesic, and 3 Xeric Plots - white spray paint used here

CH1.	Plot dimensions (m):	20 x 20
	Perimeter angles:	214/ and 304/ (from magnetic north)
	Plot aspect/slope (scale):	none / Flat (0), undulating to Moderate (2)
	Photo corner:	75/ (from magnetic north)
	UTM coordinates:	17 5 057 11 / S 42 291 20 (4/19/99, 10:30AM)

This plot is about 575m downhill from the first big left-hand curve in the hemlock-ravine trail, creek-left, about 10m off of the right side of trail.

CH2.	Plot dimensions (m):	20 x 20
	Perimeter angles:	75/ and 165/ (from magnetic north)
	Plot aspect/slope (scale):	WNW-facing / Moderate (2), undulating
	Photo corner:	200/ (from magnetic north)
	UTM coordinates:	17 5 059 62 / S 42 290 53 (4/19/99, 12:00PM)

This plot is up a side-drainage, east of the hemlock-ravine trail. About 650m downhill from the first big left-hand curve in the hemlock-ravine trail, go east (left). You should see a steep rock ledge in front of and uphill from you. Go aroung the right side of this ledge and work your way back downhill, go past a rock ledge that is about 5m from the creek in this side-drainage, and cross the creek. The plot is creek-left (the rock ledge you just went by is creek-right). The center-stake is in the middle of a pile of fallen oak branches (difficult to see, but look for flags)! One creekside corner-stake is next to a large-dbh hemlock, about 5m from the creek, while the other creekside corner-stake is next to a large-dbh red maple.

CH3.	Plot dimensions (m):	20 x 20
	Perimeter angles:	62/ and 152/ (from magnetic north)
	Plot aspect/slope (scale):	Southwest-facing / Moderately steep (3)
	Photo corner:	0/ (from magnetic north)
	UTM coordinates:	17 5 058 89 / S 42 289 88 (4/19/99, 11:00AM)

This plot is about 750m downhill from the first big left-hand curve in the hemlock-ravine trail, about 20m uphill from where the trail crosses the creek and gets much steeper. A corner-stake for this plot is about 5m off the left side of the trail. There is a lage-dbh hemlock snag (snapped off, about 10m tall) near the center of this plot.

CM1.	Plot dimensions (m):	20 x 20
	Perimeter angles:	190/ and 280/ (from magnetic north)
	Plot aspect/slope (scale):	Southeast-facing / Slight (1) to Moderate (2)
	Photo corner:	140/ (from magnetic north)
	UTM coordinates:	17 5 049 95 / S 42 285 81 (4/19/99, 8:15AM)

From the gravel parking area on the gravel road SE of the battlefield, go 150m southeast along the hiking trail. The plot is on a knoll about 15m off of the left side of the trail, about 40m before you get to the big, left-hand curve in the trail. The center-stake is behind a large hardwood and is double-flagged on a 30cm dbh hemlock's branch.

CM2.	Plot dimensions (m):	20 x 20
	Perimeter angles:	123/ and 213/ (from magnetic north)
	Plot aspect/slope (scale):	SSE-facing / Moderate (2)
	Photo corner:	170/ (from magnetic north)
	UTM coordinates:	17 5 054 79 / S 42 291 82 (4/19/99, 10:00AM)

This plot is about 250m downhill from the first big left-hand curve in the hemlock-ravine trail, about 50m off of the left-hand side of the trail. It is on top of the knoll that is behind the giant yellow-poplar on the left, about 75m uphill from the bridge.

CM3.	Plot dimensions (m):	20 x 20
	Perimeter angles:	25/ and 115/ (from magnetic north)
	Plot aspect/slope (scale):	West-facing / Moderate (2)
	Photo corner:	260/ (from magnetic north)
	UTM coordinates:	17 5 059 04 / S 42 291 00 (4/19/99, 11:30AM)

This plot is up a side-drainage, east of the hemlock-ravine trail. About 650m downhill from the first big left-hand curve in the hemlock-ravine trail, go east (left). You should see a steep rock ledge in front of and uphill from you. Go aroung the left-hand side of this ledge, uphill past a very large, fallen oak tree. The plot is creek-left, about 40m from the clearcut Park boundary.

CX1.	Plot dimensions (m):	10 x 40
	Perimeter angles:	6/ and 96/ (from magnetic north)
	Plot aspect/slope (scale):	North- to South-facing / Slight (1)
	Photo corner:	200/ (from magnetic north)
	UTM coordinates:	17 5 049 16 / S 42 288 03 (4/19/99, 7:45AM)

From the gravel parking area on the gravel road SE of the battlefield, go 100m west to a small drainage downhill of a stand of Virginia pines. The plot is creek-left, about 5m from this small drainage, in a slight hollow with northern and southern exposure.

CX2.	Plot dimensions (m):	20 x 20
	Perimeter angles:	48/ and 138/ (from magnetic north)
	Plot aspect/slope (scale):	South-facing / Moderately steep (3)
	Photo corner:	270/ (from magnetic north)
	UTM coordinates:	17 5 054 36 / S 42 287 56 (4/19/99, 9:00AM)

This plot is SE of the ball field and the Virginia pine stand, about 30m downhill from the trail that parallels the edge of the gorge.

CX3.	Plot dimensions (m):	20 x 20
	Perimeter angles:	103/ and 213/ (from magnetic north)
	Plot aspect/slope (scale):	Northwest-facing / Moderate (2)
	Photo corner:	150/ (from magnetic north)
	UTM coordinates:	17 5 053 06 / S 42 289 38 (4/19/99, 9:30AM)

This plot is at the first big left-hand curve in the hemlock-ravine trail, about 15m up slope on the right-hand side of the trail.

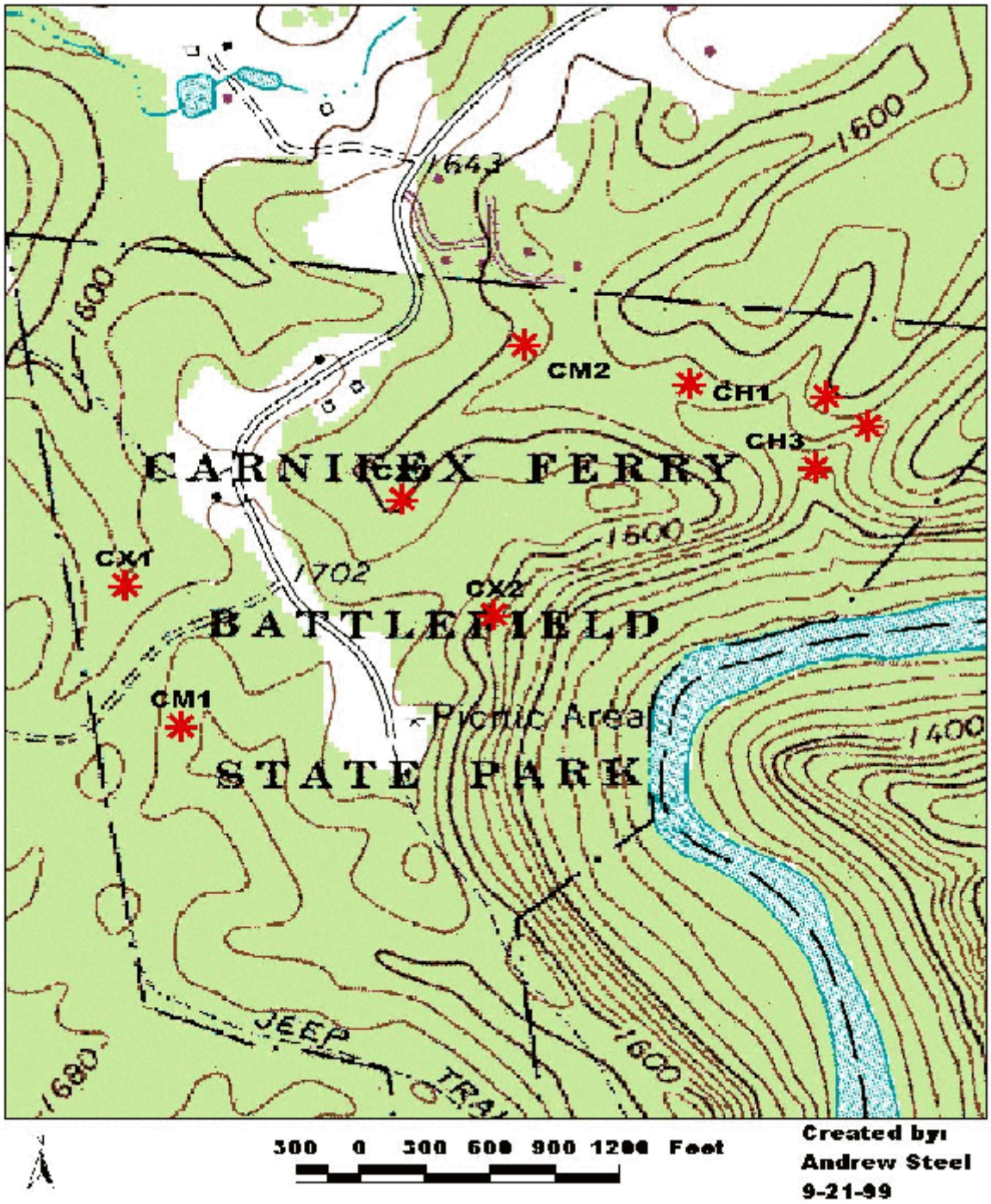

Figure A-1. Carnifex Ferry Battlefield State Park hydric, mesic, and xeric plot locations, Summersville Dam quadrangle, based on UTM coordinates obtained with a Trimble Scout GPS unit with Acu-Lock software.

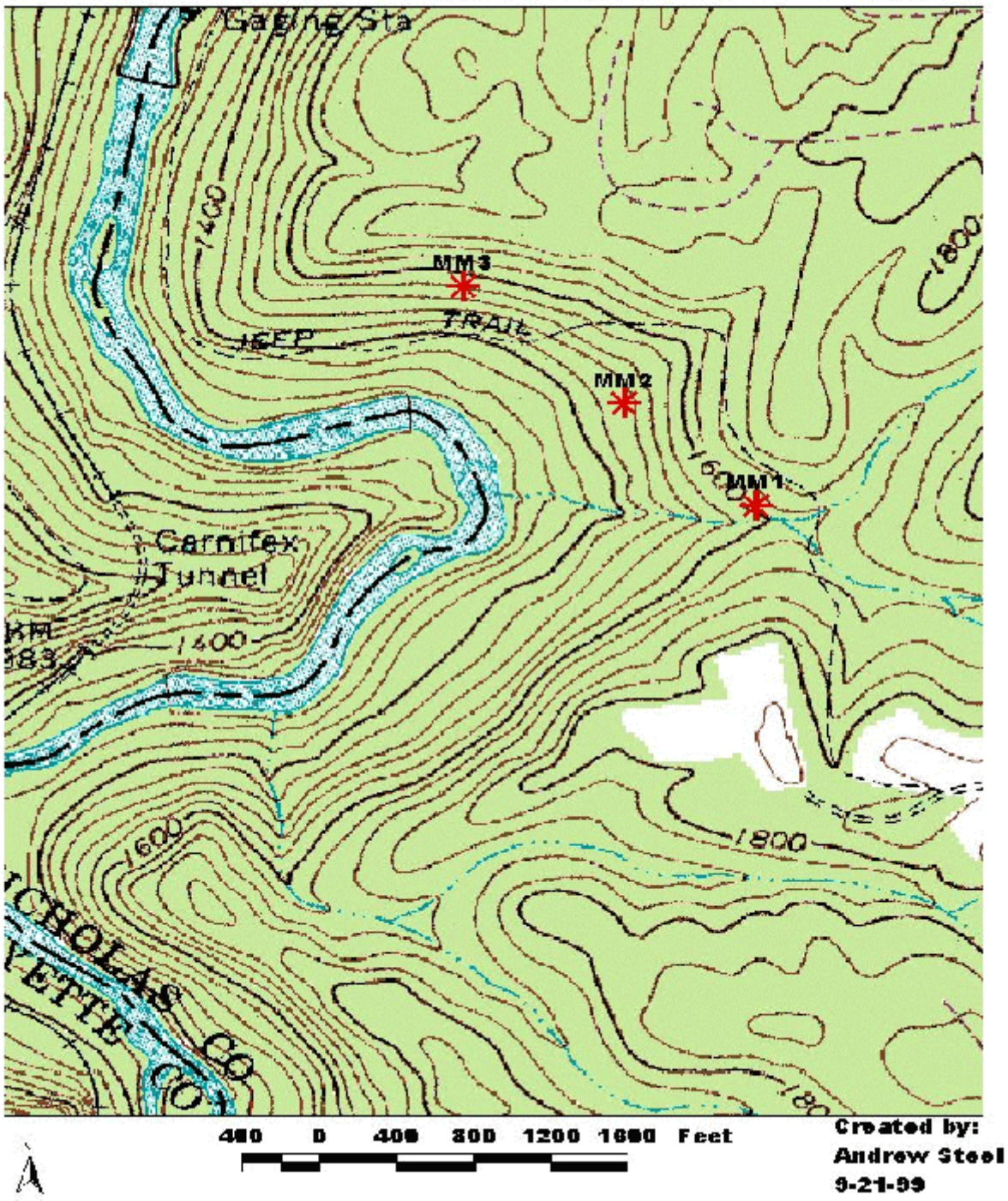

Figure A-2. Meadow River mesic plot locations, Summersville Dam quadrangle, based on UTM coordinates obtained on a Trimble Scout GPS unit with Acu-Lock software.

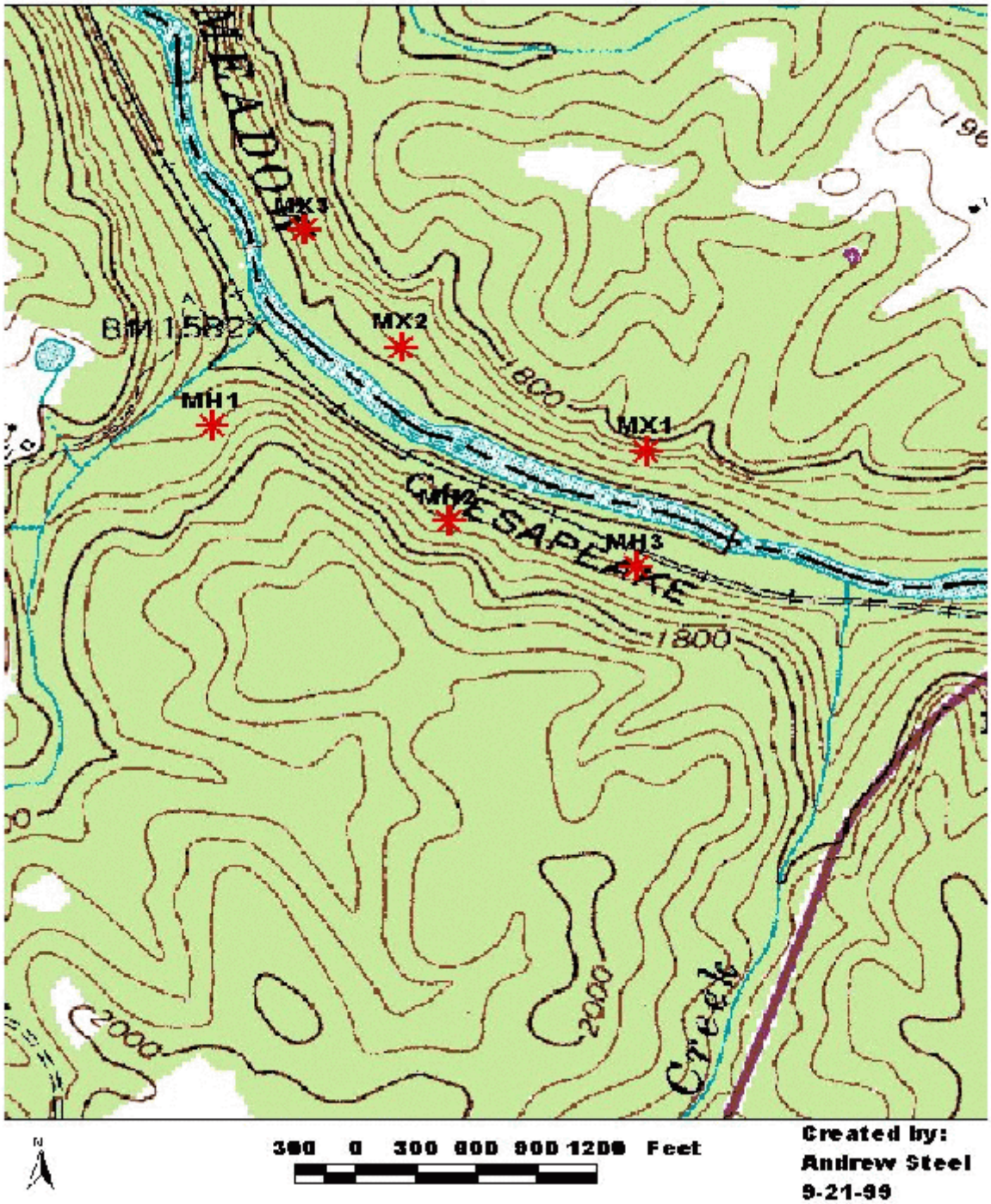

Figure A-3. Meadow River hydric and xeric plot locations, Summersville Dam quadrangle, based on UTM coordinates obtained on a Trimble Scout GPS unit with Acu-Lock software.

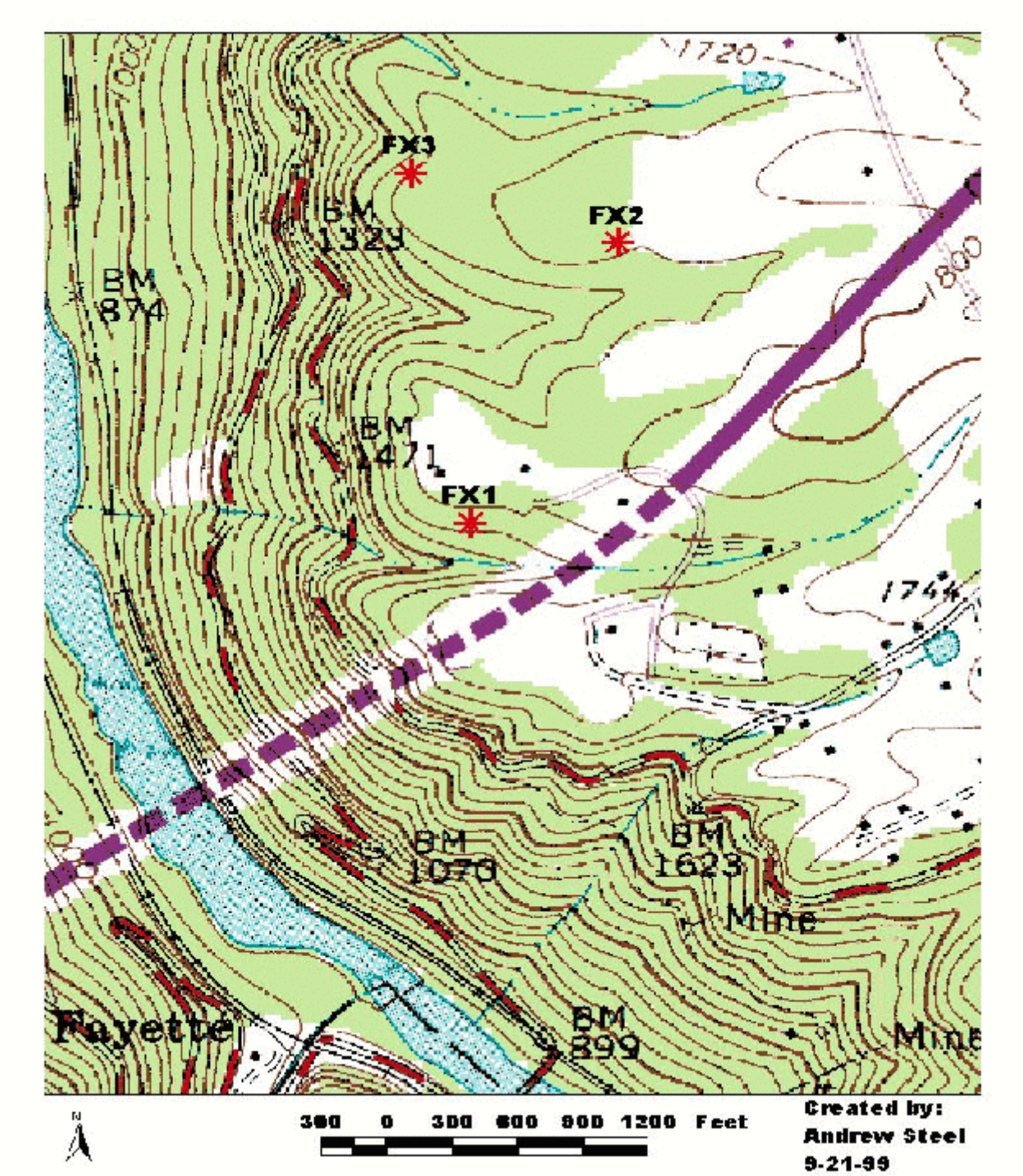

Figure A-4. Fayetteville xeric plot locations, Fayetteville quadrangle, based on UTM coordinates obtained on a Trimble Scout GPS unit with Acu-Lock software.

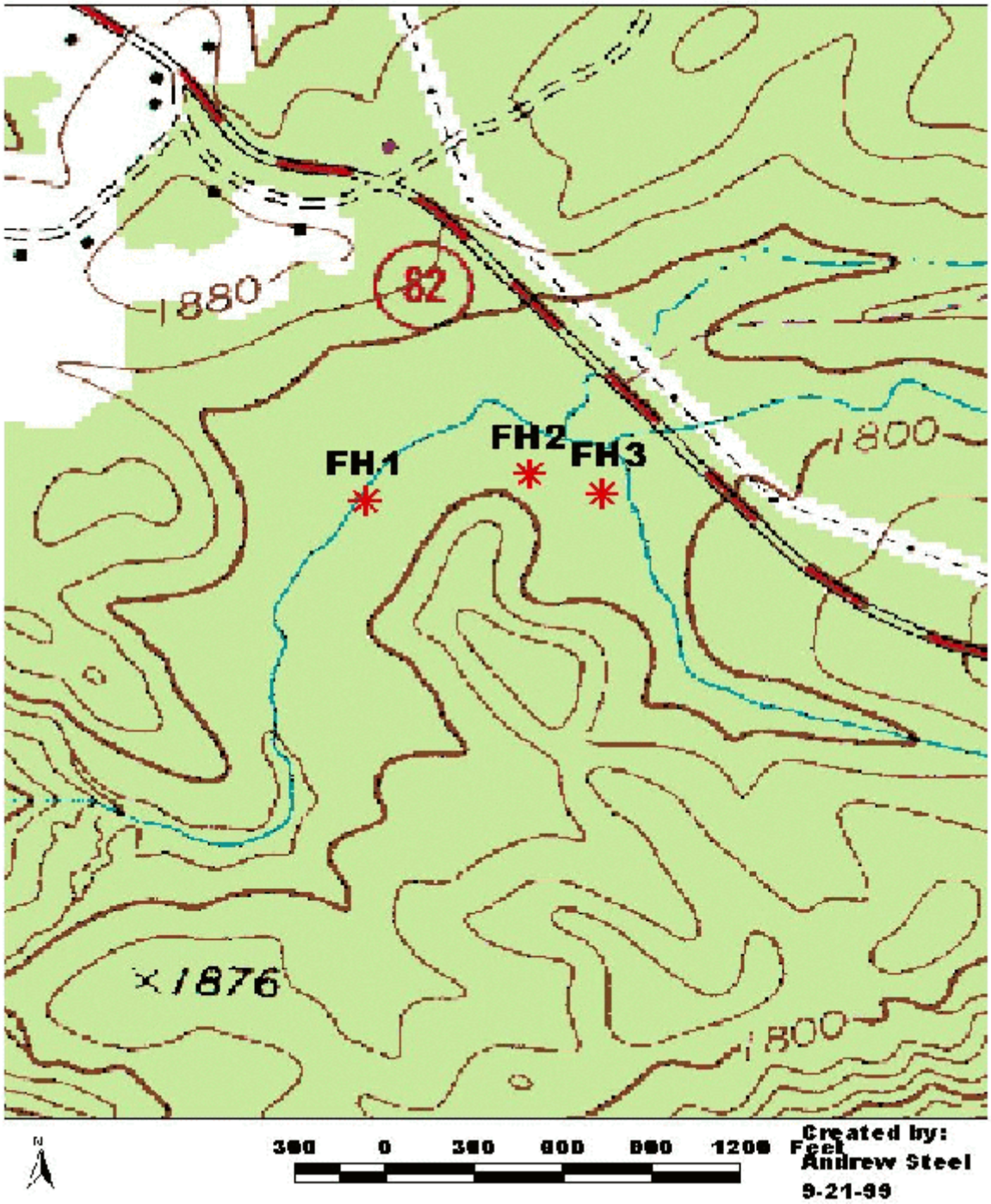

Figure A-5. Fayetteville hydric plot locations, Fayetteville quadrangle, based on UTM coordinates obtained on a Trimble Scout GPS unit with Acu-Lock software.

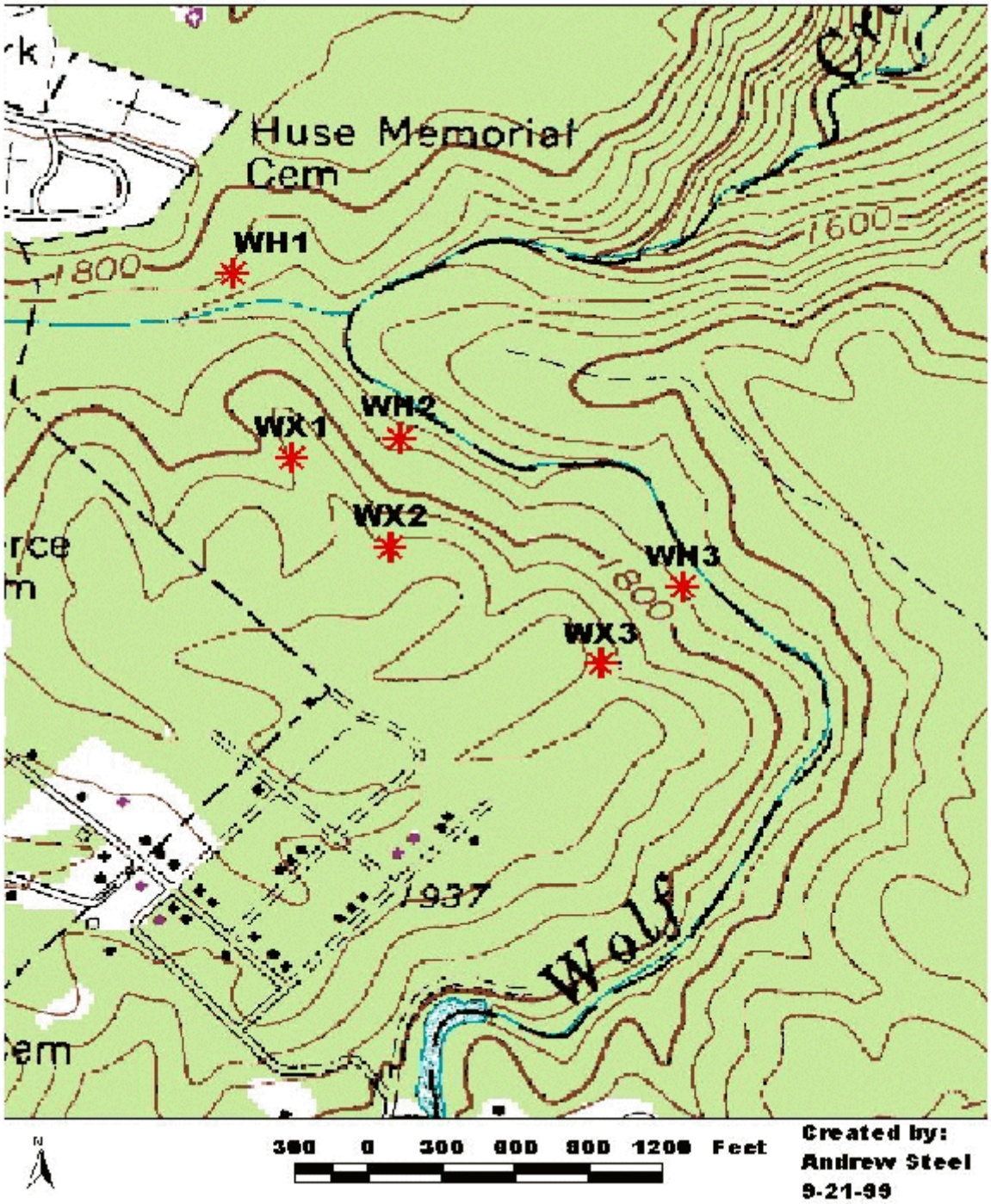

Figure A-6. Wolf Creek hydric and xeric plot locations, Fayetteville quadrangle, based on UTM coordinates obtained on a Trimble Scout GPS unit with Acu-Lock software.

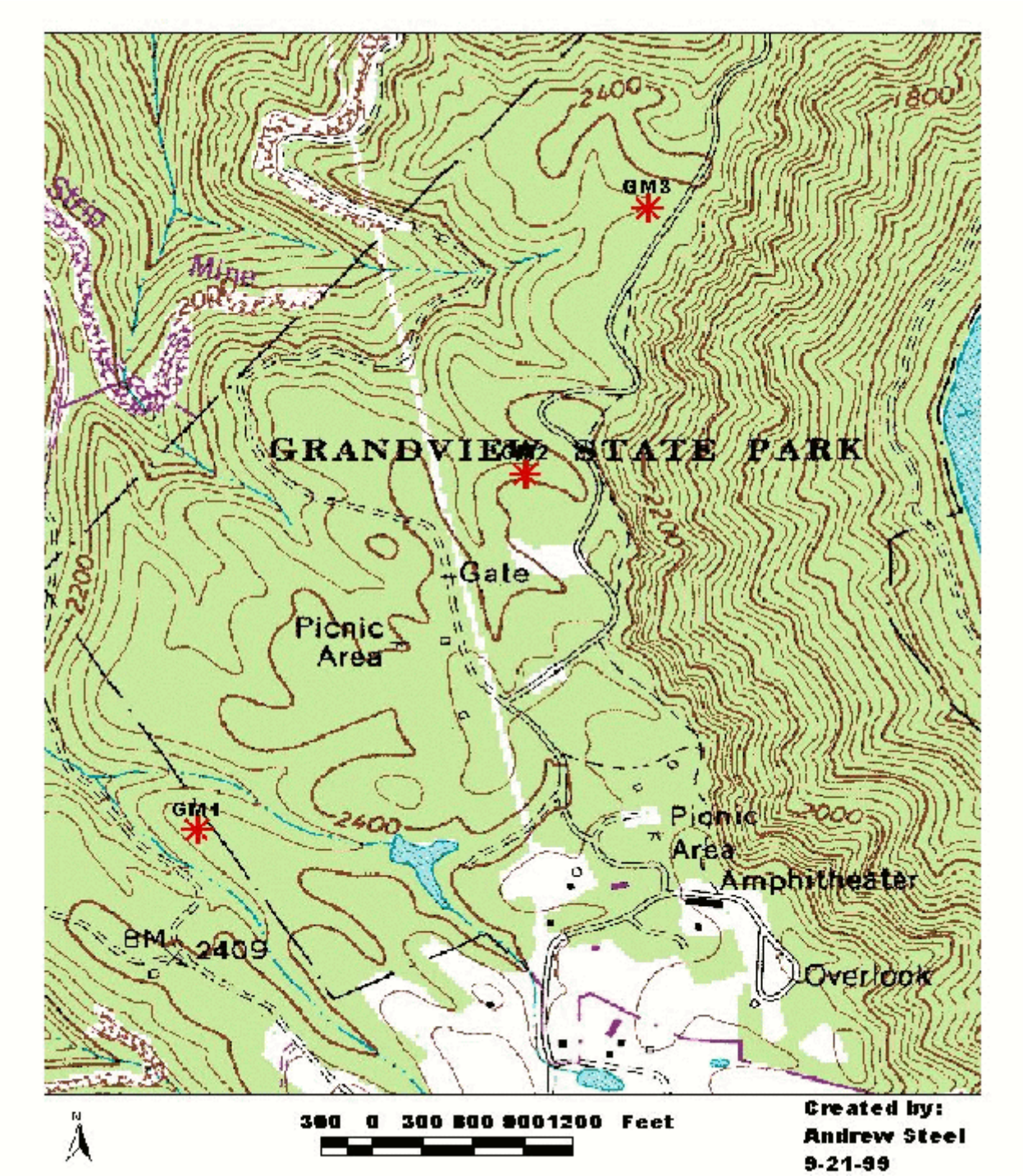

Figure A-7. Grandview mesic plot locations, Prince quadrangle, based on UTM coordinates obtained on a Trimble Scout GPS unit with Acu-Lock software.

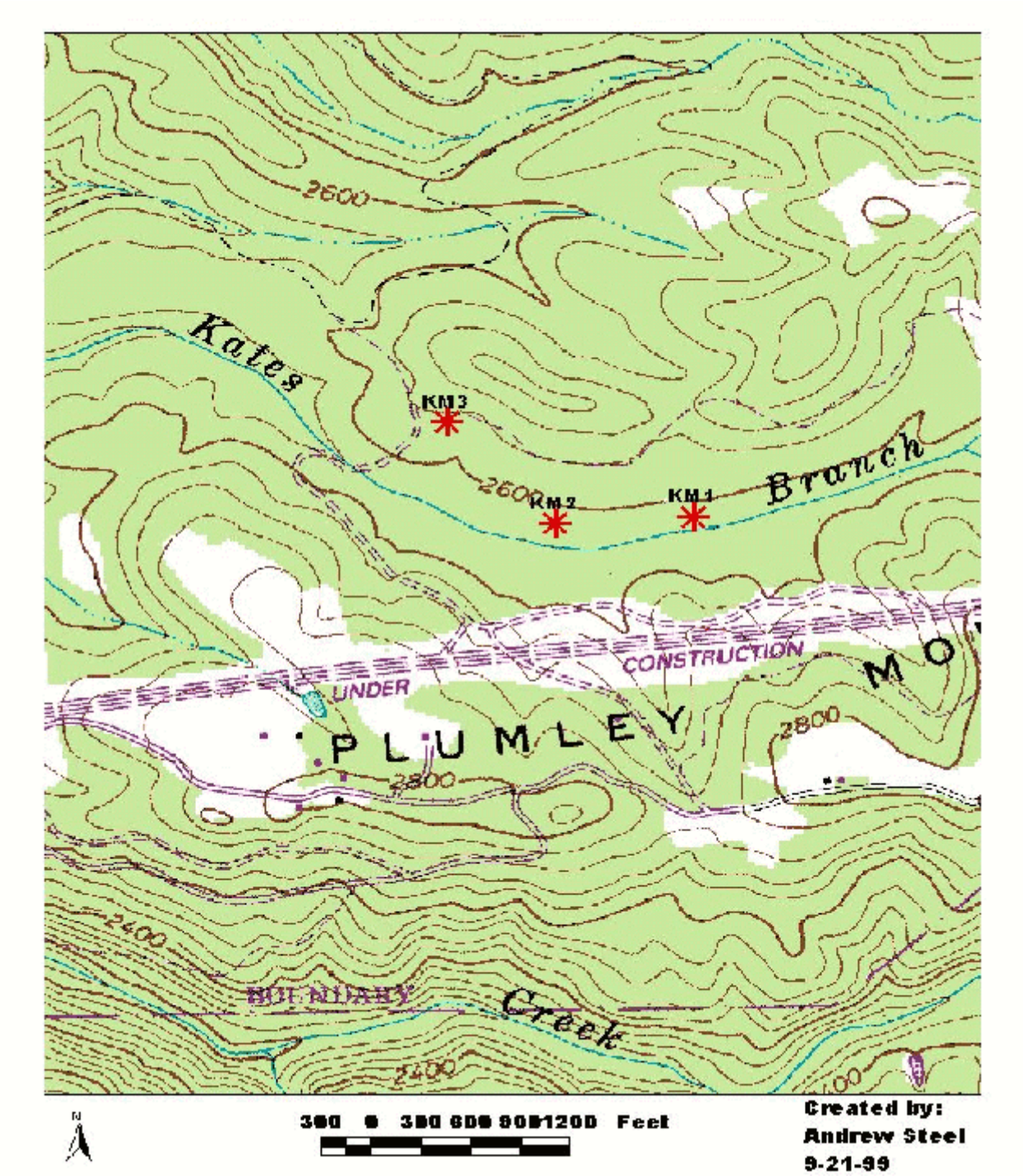

Figure A-8. Kates Branch mesic plot locations, Prince quadrangle, based on UTM coordinates obtained on a Trimble Scout GPS unit with Acu-Lock software.

Appendix B. Number of live trees by species, and number of dead pine, hemlock, and hardwood trees in each of the 400m^2 hemlock ecosystem monitoring plots. Hemlocks and pines were sampled in November, 1998, while hardwoods were sampled in July, 1999. Each plot is identified by a three-character code. The first character of the code represents the geographic location of the plot: F=Fayetteville, W=Wolf Creek, K=Kates Branch, G=Grandview, M=Meadow River, and C=Carnifex Ferry State Park. The second character equates with the principle study design, which consists of 3 levels along a moisture gradient; H=Hydric, M=Mesic, and X=Xeric. The third character is the replication number.

Species or Group	CH1	CH2	CH3	CM1	CM2	CM3	CX1	CX2	CX3
Acer pensylvanicum	0	0	0	0	0	0	0	0	0
Acer rubrum	1	0	2	5	2	0	3	3	0
Acer saccharum	0	0	0	0	0	0	0	1	0
Acer spicatum	0	0	0	0	2	1	0	0	0
Betula alleghaniensis	0	0	0	0	0	0	0	0	0
Betula lenta	4	1	3	0	0	0	0	0	1
Carya glabra	0	0	0	1	0	0	1	2	0
Carya ovata	0	0	0	0	0	0	0	0	0
Carya tomentosa	0	0	0	0	0	0	1	5	0
Cornus florida	0	0	0	0	0	0	1	0	0
Fagus grandifolia	0	0	0	0	1	1	0	0	0
Ilex opaca	0	0	0	0	0	1	0	0	0
Liriodendron tulipifera	0	0	3	12	0	0	1	2	0
Magnolia acuminata	0	0	0	0	0	0	0	0	0
Magnolia fraseri	2	3	2	0	0	2	0	0	0
Nyssa sylvatica	0	0	0	0	1	0	1	0	0
Oxydendrum arboreum	0	1	0	0	1	3	1	0	0
Pinus strobus	0	0	0	0	0	0	0	0	0
Prunus serotina	0	0	0	0	0	0	0	0	0
Quercus alba	0	1	0	0	2	2	3	1	6
Quercus coccinea	0	0	0	0	0	0	0	0	0
Quercus prinus	0	0	0	0	0	0	0	0	0
Quercus rubra	0	1	0	1	1	0	0	1	0
Quercus velutina	0	0	0	0	0	0	1	0	1
Rhododendron maximum	1	0	0	0	0	0	0	0	0
Sassafras albidum	0	0	0	0	0	0	0	0	0
Tilia americana	0	0	0	1	0	0	0	0	0
Tsuga canadensis	3	7	9	7	9	9	11	28	18
	11	14	19	27	19	19	24	43	26
Dead White Pines	0	0	0	0	0	0	1	0	0
Dead Hardwood Trees	1	1	0	1	1	2	2	1	2
Dead Hemlocks	0	0	1	0	2	0	0	2	4
	1	1	1	1	3	2	3	3	6

Appendix B. Continued.

Species or Group	MH1	MH2	MH3	MM1	MM2	MM3	MX1	MX2	MX3
Acer pensylvanicum	0	0	0	0	0	0	0	0	0
Acer rubrum	4	2	0	1	1	1	1	6	2
Acer saccharum	0	0	0	0	3	0	0	2	2
Acer spicatum	0	0	0	0	0	0	0	0	0
Betula alleghaniensis	0	1	2	0	0	0	0	0	0
Betula lenta	7	2	11	4	2	0	0	3	1
Carya glabra	0	0	0	0	1	0	0	0	0
Carya ovata	0	0	0	0	0	0	0	0	0
Carya tomentosa	0	0	0	1	0	0	0	0	0
Cornus florida	0	0	0	0	0	0	0	0	0
Fagus grandifolia	0	0	0	0	1	1	1	0	1
Ilex opaca	0	0	0	0	0	0	0	1	2
Liriodendron tulipifera	1	0	0	8	0	0	0	0	0
Magnolia acuminata	0	0	0	0	0	0	0	0	0
Magnolia fraseri	0	0	0	0	0	0	0	0	0
Nyssa sylvatica	0	0	0	1	0	0	7	1	0
Oxydendrum arboreum	0	0	4	0	0	0	0	7	0
Pinus strobus	0	0	0	0	0	0	0	0	0
Prunus serotina	0	0	0	1	0	0	0	1	0
Quercus alba	0	0	0	0	0	0	0	0	4
Quercus coccinea	0	0	0	0	0	0	0	0	2
Quercus prinus	0	0	0	0	1	1	7	0	2
Quercus rubra	0	0	0	0	0	0	3	2	4
Quercus velutina	0	0	0	0	1	1	3	1	1
Rhododendron maximum	0	0	0	0	0	0	0	0	0
Sassafras albidum	2	0	0	0	0	0	0	0	0
Tilia americana	0	0	0	1	1	0	0	0	0
Tsuga canadensis	18	11	14	18	15	21	4	6	9
	32	16	31	35	26	25	26	30	30
Dead White Pines	0	0	0	0	0	0	0	0	0
Dead Hardwood Trees	2	1	2	4	2	2	1	3	3
Dead Hemlocks	1	1	0	0	3	7	0	0	1
	3	2	2	4	5	9	1	3	4

Appendix B. Continued.

Species or Group	FH1	FH2	FH3	FX1	FX2	FX3
Acer pensylvanicum	0	0	0	0	0	0
Acer rubrum	3	1	4	0	0	5
Acer saccharum	0	0	0	0	0	0
Acer spicatum	0	0	0	0	0	0
Betula alleghaniensis	0	0	0	0	0	0
Betula lenta	1	6	6	0	0	0
Carya glabra	0	0	0	0	0	1
Carya ovata	0	0	0	0	0	0
Carya tomentosa	0	0	0	0	0	0
Cornus florida	0	0	0	0	0	0
Fagus grandifolia	0	0	1	0	3	0
Ilex opaca	0	0	0	0	0	2
Liriodendron tulipifera	1	3	3	1	0	0
Magnolia acuminata	0	0	1	0	0	0
Magnolia fraseri	0	0	1	0	0	0
Nyssa sylvatica	1	0	0	0	0	0
Oxydendrum arboreum	0	1	0	1	0	0
Pinus strobus	0	0	0	3	0	0
Prunus serotina	0	0	0	0	0	0
Quercus alba	3	1	0	0	0	2
Quercus coccinea	0	0	0	0	0	0
Quercus prinus	0	0	0	0	0	1
Quercus rubra	0	0	0	0	1	0
Quercus velutina	0	2	0	1	0	0
Rhododendron maximum	0	0	0	0	1	0
Sassafras albidum	0	0	0	0	0	0
Tilia americana	0	0	0	0	0	0
Tsuga canadensis	11	13	16	18	11	18
	20	27	32	24	16	29
Dead White Pines	0	0	0	0	0	0
Dead Hardwood Trees	4	2	0	0	1	1
Dead Hemlocks	2	0	0	0	0	3
	6	2	0	0	1	4

Appendix B. Continued.

Species or Group	WH1	WH2	WH3	WX1	WX2	WX3
Acer pensylvanicum	0	0	0	0	0	0
Acer rubrum	1	1	4	2	0	3
Acer saccharum	0	0	0	0	0	0
Acer spicatum	0	0	0	0	0	0
Betula alleghaniensis	0	1	0	0	0	0
Betula lenta	4	9	4	2	2	5
Carya glabra	0	0	0	2	2	0
Carya ovata	0	0	0	0	0	0
Carya tomentosa	0	0	0	0	0	0
Cornus florida	0	0	0	0	0	0
Fagus grandifolia	0	0	1	0	0	0
Ilex opaca	0	0	0	0	0	0
Liriodendron tulipifera	3	2	1	0	0	0
Magnolia acuminata	0	1	0	0	0	0
Magnolia fraseri	1	0	0	0	0	0
Nyssa sylvatica	0	0	0	1	2	0
Oxydendrum arboreum	1	0	0	1	1	0
Pinus strobus	0	0	0	0	0	0
Prunus serotina	0	3	1	0	0	0
Quercus alba	0	0	0	0	0	0
Quercus coccinea	0	0	0	0	0	0
Quercus prinus	0	0	0	2	2	2
Quercus rubra	1	0	0	2	0	1
Quercus velutina	0	0	0	0	0	0
Rhododendron maximum	0	0	0	0	0	0
Sassafras albidum	0	0	0	0	0	0
Tilia americana	0	0	0	0	0	0
Tsuga canadensis	25	8	25	10	7	21
	36	25	36	22	16	32
Dead White Pines	0	0	0	0	0	0
Dead Hardwood Trees	0	1	0	2	0	3
Dead Hemlocks	2	0	3	0	0	2
	2	1	3	2	0	5

Appendix B. Continued.

Species or Group	GM1	GM2	GM3	KM1	KM2	KM3
Acer pensylvanicum	0	0	0	0	0	1
Acer rubrum	0	4	0	0	1	8
Acer saccharum	0	0	0	0	0	0
Acer spicatum	0	0	0	0	0	0
Betula alleghaniensis	0	0	0	0	0	0
Betula lenta	5	5	3	4	0	0
Carya glabra	0	0	0	0	0	0
Carya ovata	0	0	1	0	0	0
Carya tomentosa	0	0	0	0	0	0
Cornus florida	0	0	0	0	0	0
Fagus grandifolia	2	0	0	0	0	1
Ilex opaca	0	0	0	0	0	0
Liriodendron tulipifera	5	7	11	2	4	0
Magnolia acuminata	1	0	0	1	0	1
Magnolia fraseri	0	0	0	0	0	0
Nyssa sylvatica	0	0	0	0	0	0
Oxydendrum arboreum	1	0	0	2	4	2
Pinus strobus	0	3	0	1	0	0
Prunus serotina	0	0	0	0	0	0
Quercus alba	0	0	0	0	6	1
Quercus coccinea	0	0	0	1	0	0
Quercus prinus	0	0	0	0	0	1
Quercus rubra	0	0	0	4	1	4
Quercus velutina	0	0	0	0	1	2
Rhododendron maximum	1	4	0	0	0	0
Sassafras albidum	0	0	0	0	0	0
Tilia americana	0	0	0	0	0	0
Tsuga canadensis	10	10	19	16	9	18
	25	33	34	31	26	39
Dead White Pines	0	1	0	0	0	0
Dead Hardwood Trees	1	1	4	3	2	2
Dead Hemlocks	0	0	1	0	0	1
	1	2	5	3	2	3

Appendix C. Number of live saplings (<8cm dbh and ≥1.4m tall) and shrubs (>1.4m tall) by species, and number of dead hemlocks, hardwoods, and shrubs in each of the 400m² hemlock ecosystem monitoring plots. These data are summed together for the four 2-by-10m belt-transects sampled per plot in July, 1999. Each plot is identified by a three-character code. The first character of the code represents the geographic location of the plot: F=Fayetteville, W=Wolf Creek, K=Kates Branch, G=Grandview, M=Meadow River, and C=Carnifex Ferry State Park. The second character equates with the principle study design, which consists of 3 levels along a moisture gradient; H=Hydric, M=Mesic, and X=Xeric. The third character is the replication number.

Growth Form	Species or Group	CH1	CH2	CH3	CM1	CM2	CM3	CX1	CX2	CX3
Trees	Acer pensylvanicum	0	0	0	0	0	0	0	0	0
	Acer rubrum	0	0	0	1	0	0	0	0	0
	Betula lenta	1	0	0	0	0	0	0	0	0
	Carya glabra	0	0	0	0	0	0	1	0	0
	Fagus grandifolia	0	0	0	0	0	0	0	0	0
	Liriodendron tulipifera	3	0	0	0	0	0	0	0	0
	Magnolia fraseri	0	0	11	0	1	0	0	0	0
	Magnolia tripetala	0	1	0	0	0	0	0	0	0
	Nyssa sylvatica	0	1	0	0	0	0	0	0	0
	Oxydendrum arboreum	0	1	0	0	0	0	0	0	0
	Prunus serotina	0	0	0	0	0	0	0	0	0
	Sassafras albidum	0	0	0	0	0	0	0	0	0
	Tsuga canadensis	17	11	0	0	4	1	3	7	1
Shrubs	Clethra acuminata	0	0	0	0	0	0	0	0	0
	Hamamelis virginiana	0	0	0	0	0	0	0	0	0
	Ilex montana	0	0	0	0	0	0	0	0	0
	Ilex opaca	0	0	0	0	1	1	0	0	0
	Kalmia latifolia	0	0	0	0	0	0	0	0	0
	Prunus pensylvanica	0	0	0	0	0	0	0	0	0
	Rhododendron maximum	42	29	41	0	0	10	0	0	0
	Rhus glabra	0	0	0	0	0	0	0	0	0
Vines	Vitis aestivalis	0	0	0	0	0	0	0	0	0
		63	43	52	1	6	12	4	7	1
Trees (dead)	Hardwoods	3	0	0	0	0	0	0	0	2
	Hemlocks	2	0	0	0	0	0	0	1	0
Shrubs (dead)	Shrubs	0	2	2	1	0	0	0	0	0
		5	2	2	1	0	0	0	1	2

Appendix C. Continued.

Growth Form	Species or Group	MH1	MH2	MH3	MM1	MM2	MM3	MX1	MX2	MX3
Trees	Acer pensylvanicum	0	0	0	0	0	0	0	0	0
	Acer rubrum	0	0	0	0	0	0	0	1	0
	Betula lenta	0	2	0	0	0	0	0	0	0
	Carya glabra	0	0	0	0	0	0	0	0	0
	Fagus grandifolia	0	0	0	0	0	0	0	0	0
	Liriodendron tulipifera	0	0	0	0	0	0	0	0	0
	Magnolia fraseri	0	0	0	0	0	0	0	0	0
	Magnolia tripetala	0	0	0	0	0	0	0	0	0
	Nyssa sylvatica	0	0	0	0	0	0	2	1	0
	Oxydendrum arboreum	0	0	0	0	0	0	0	0	0
	Prunus serotina	0	0	0	0	0	0	0	0	0
	Sassafras albidum	0	0	0	0	0	0	2	0	0
	Tsuga canadensis	4	0	8	3	0	0	0	1	0
Shrubs	Clethra acuminata	1	0	6	0	0	0	0	0	0
	Hamamelis virginiana	0	6	0	0	0	0	7	0	1
	Ilex montana	0	2	5	0	0	0	0	0	0
	Ilex opaca	0	0	0	0	0	0	1	2	2
	Kalmia latifolia	0	0	0	0	0	0	2	0	0
	Prunus pensylvanica	0	0	0	0	0	0	0	0	0
	Rhododendron maximum	28	27	41	8	0	0	4	10	10
	Rhus glabra	0	1	0	0	0	0	0	0	0
Vines	Vitis aestivalis	0	0	0	0	0	0	0	0	0
		33	38	60	11	0	0	18	15	13
Trees (dead)	Hardwoods	0	0	1	0	0	0	1	0	1
	Hemlocks	1	0	0	0	0	1	0	0	0
Shrubs (dead)	Shrubs	0	4	6	0	0	0	14	3	17
		1	4	7	0	0	1	15	3	18

Appendix C. Continued.

Growth Form	Species or Group	FH1	FH2	FH3	FX1	FX2	FX3
Trees	Acer pensylvanicum	0	0	0	0	0	0
	Acer rubrum	0	1	0	0	1	0
	Betula lenta	0	0	0	0	0	0
	Carya glabra	0	0	0	0	0	0
	Fagus grandifolia	0	1	0	2	1	1
	Liriodendron tulipifera	0	0	0	0	0	0
	Magnolia fraseri	0	0	0	0	0	0
	Magnolia tripetala	0	0	0	0	0	0
	Nyssa sylvatica	1	0	0	0	0	0
	Oxydendrum arboreum	0	1	0	0	1	0
	Prunus serotina	0	0	0	0	0	0
	Sassafras albidum	0	0	0	0	0	0
	Tsuga canadensis	6	24	10	5	11	1
Shrubs	Clethra acuminata	0	0	0	0	0	0
	Hamamelis virginiana	3	0	0	0	0	0
	Ilex montana	0	0	0	0	0	0
	Ilex opaca	2	1	0	0	0	0
	Kalmia latifolia	0	0	0	0	0	0
	Prunus pensylvanica	0	0	0	0	0	0
	Rhododendron maximum	15	19	18	0	0	0
	Rhus glabra	0	0	0	0	0	0
Vines	Vitis aestivalis	0	0	0	0	0	0
		27	47	28	7	14	2
Trees (dead)	Hardwoods	0	0	0	0	0	0
	Hemlocks	1	0	1	0	2	0
Shrubs (dead)	Shrubs	2	0	0	0	0	0
		3	0	1	0	2	0

Appendix C. Continued.

Growth Form	Species or Group	WH1	WH2	WH3	WX1	WX2	WX3
Trees	Acer pensylvanicum	0	0	0	0	0	0
	Acer rubrum	0	0	0	4	7	0
	Betula lenta	0	0	0	0	0	0
	Carya glabra	0	0	0	0	0	0
	Fagus grandifolia	0	0	0	3	1	0
	Liriodendron tulipifera	0	0	0	0	0	0
	Magnolia fraseri	0	0	0	1	0	0
	Magnolia tripetala	0	0	0	0	0	0
	Nyssa sylvatica	0	0	0	0	0	0
	Oxydendrum arboreum	0	0	0	0	0	0
	Prunus serotina	0	0	0	0	0	0
	Sassafras albidum	0	0	0	0	0	0
	Tsuga canadensis	1	2	2	12	6	4
Shrubs	Clethra acuminata	0	0	0	0	0	0
	Hamamelis virginiana	0	0	5	0	0	0
	Ilex montana	0	0	0	0	0	0
	Ilex opaca	0	0	0	0	0	0
	Kalmia latifolia	0	0	0	0	0	0
	Prunus pensylvanica	0	0	0	0	2	0
	Rhododendron maximum	19	24	56	0	0	2
	Rhus glabra	0	0	0	0	0	0
Vines	Vitis aestivalis	0	1	0	0	0	0
		20	27	63	20	16	6
Trees (dead)	Hardwoods	0	0	0	2	0	0
	Hemlocks	0	0	0	0	0	0
Shrubs (dead)	Shrubs	0	0	0	0	0	0
		0	0	0	2	0	0

Appendix C. Continued.

Growth Form	Species or Group	GM1	GM2	GM3	KM1	KM2	KM3
Trees	Acer pensylvanicum	0	1	0	0	0	0
	Acer rubrum	0	0	0	0	0	0
	Betula lenta	0	0	0	0	1	0
	Carya glabra	0	0	0	0	0	0
	Fagus grandifolia	0	0	0	0	0	8
	Liriodendron tulipifera	0	0	0	1	10	0
	Magnolia fraseri	0	0	0	0	0	0
	Magnolia tripetala	0	0	0	0	0	0
	Nyssa sylvatica	0	0	0	0	2	0
	Oxydendrum arboreum	0	0	0	0	1	0
	Prunus serotina	0	0	0	1	0	1
	Sassafras albidum	0	0	0	0	0	0
	Tsuga canadensis	1	1	4	9	1	3
Shrubs	Clethra acuminata	0	0	0	0	0	0
	Hamamelis virginiana	0	0	0	1	0	0
	Ilex montana	0	0	0	0	0	0
	Ilex opaca	0	0	0	0	0	0
	Kalmia latifolia	0	0	0	3	0	0
	Prunus pensylvanica	0	0	0	0	0	0
	Rhododendron maximum	2	1	1	0	0	0
	Rhus glabra	0	0	0	0	0	0
Vines	Vitis aestivalis	0	0	0	0	0	0
		3	3	5	15	15	12
Trees (dead)	Hardwoods	1	0	1	0	5	1
	Hemlocks	0	0	0	1	0	3
Shrubs (dead)	Shrubs	1	0	0	1	4	0
		2	0	1	2	9	4

Appendix D. Mean total cover (%) by strata on four 10m line transects per plot, July, 1999. The first character of the code represents the geographic location of the plot: F=Fayetteville, W=Wolf Creek, K=Kates Branch, G=Grandview, M=Meadow River, and C=Carnifex Ferry State Park. The second character equates with the principle study design, which consists of 3 levels along a moisture gradient; H=Hydric, M=Mesic, and X=Xeric. The third character is replication number.

Stratum	Cover Component	CH1	CH2	CH3	CM1	CM2	CM3	CX1	CX2	CX3
Supercanopy	Hemlock trees	0.0	0.0	0.0	0.0	0.0	25.0	0.0	0.0	0.0
	Hardwood trees	5.3	0.0	0.0	0.0	0.0	25.0	0.0	0.0	0.0
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canopy	Hemlock trees	84.5	51.3	43.3	0.0	13.8	39.8	0.0	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	97.5	93.5	45.5	75.0	76.3	76.8
	Vines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Boles	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subcanopy	Hemlock trees	0.0	22.8	2.5	74.8	45.3	0.0	69.8	43.5	90.8
	Hardwood trees	12.0	13.5	27.8	19.3	22.5	0.0	6.0	29.8	0.5
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
	Vines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
High Midstory	Hemlock trees	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Hardwood trees	12.8	0.0	0.0	0.0	0.0	0.0	12.5	0.0	0.0
Low Midstory	Hemlock trees	6.3	16.5	0.0	0.0	6.8	22.5	9.0	27.8	4.8
	Hardwood trees	0.0	0.0	2.8	0.0	0.0	13.5	4.0	0.0	0.0
	Vines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Evergreen shrubs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Deciduous shrubs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Stems	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sticks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shrub Layer	Hemlock trees	4.0	0.0	0.0	0.0	15.0	1.8	3.8	18.3	0.0
	Hardwood trees	13.8	0.0	7.8	0.0	4.5	7.0	0.0	0.0	0.0
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Evergreen shrubs	53.0	32.0	58.5	0.0	0.0	15.3	0.0	0.0	0.0
	Deciduous shrubs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Boles	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Stems	0.5	1.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0
	Sticks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uprooted Trees	Hemlock trees	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Hardwood trees	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Understory	Hemlock trees	0.8	0.5	2.8	0.0	0.0	0.0	0.3	0.0	0.0
	Hardwood trees	1.8	5.3	0.0	1.0	0.3	0.5	1.8	0.3	0.3
	Vines	0.0	0.0	0.0	2.5	0.0	0.0	2.8	0.3	0.0
	Evergreen shrubs	35.3	43.5	49.8	0.5	0.0	13.5	0.0	0.0	0.0
	Deciduous shrubs	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
	Clubmosses	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
	Bryophytes	4.5	7.3	4.8	1.3	0.8	1.5	4.3	3.8	4.3
	Ferns	0.3	0.0	0.0	13.0	0.0	0.0	1.5	1.5	0.0
	Broadleaf Herbs	1.3	0.0	0.0	5.0	0.3	0.8	1.3	0.0	0.0
	Grasses/Sedges	0.0	0.0	0.0	1.3	0.0	0.0	0.8	0.0	0.0
	Leaf litter	96.3	99.3	99.3	99.8	99.0	97.5	96.5	94.0	95.3
	Boles	6.8	13.0	2.3	0.5	0.3	1.8	1.0	6.3	1.3
	Stems	7.8	13.8	5.8	3.3	4.3	1.0	6.0	4.5	5.3
	Sticks	27.5	21.8	17.8	7.5	23.5	13.5	22.5	16.8	16.0
	Bare Ground	0.8	0.0	0.0	0.5	0.5	0.0	0.8	0.0	0.0
	Bare Rock	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.3	0.0
	Live Tree Trunks	3.0	0.0	0.0	0.0	0.0	2.5	1.5	1.0	3.8

Appendix D. Continued.

Stratum	Cover Component	MH1	MH2	MH3	MM1	MM2	MM3	MX1	MX2	MX3
Supercanopy	Hemlock trees	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canopy	Hemlock trees	37.5	52.0	85.8	0.0	30.8	86.5	4.8	0.0	0.0
	Hardwood trees	42.0	22.5	0.0	76.3	76.0	0.0	63.3	78.0	82.5
	Vines	0.0	0.0	0.0	0.0	0.0	16.5	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subcanopy	Hemlock trees	23.5	0.0	0.0	58.5	56.0	15.3	29.0	12.0	47.5
	Hardwood trees	37.0	31.8	59.8	31.5	12.8	12.8	35.5	49.8	51.3
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0
High Midstory	Hemlock trees	31.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Hardwood trees	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low Midstory	Hemlock trees	7.3	16.5	33.0	24.0	0.0	9.5	8.8	20.5	0.0
	Hardwood trees	0.0	0.0	2.3	0.0	0.0	0.0	15.3	23.0	3.5
	Vines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0
	Evergreen shrubs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	9.0
	Deciduous shrubs	8.8	10.0	2.5	0.0	0.0	0.0	11.8	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Stems	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sticks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shrub Layer	Hemlock trees	0.0	0.0	13.5	0.0	1.0	0.0	0.0	1.8	0.0
	Hardwood trees	0.0	2.8	0.0	2.3	3.3	3.0	7.0	1.0	1.5
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vines	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0
	Evergreen shrubs	20.3	14.0	43.8	2.0	0.0	3.8	10.5	14.5	11.8
	Deciduous shrubs	0.0	2.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Stems	0.3	6.5	0.0	0.0	0.0	0.0	0.3	0.3	0.0
	Sticks	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uprooted Trees	Hemlock trees	0.0	1.3	0.0	0.3	4.5	0.0	0.0	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Understory	Hemlock trees	1.0	0.5	2.3	5.0	1.0	0.0	0.0	0.0	0.0
	Hardwood trees	0.0	2.8	0.0	2.5	2.8	0.3	8.8	0.3	0.3
	Vines	0.0	0.3	0.0	0.3	1.3	1.5	5.0	3.8	0.0
	Evergreen shrubs	55.0	37.5	40.3	20.3	0.0	4.5	24.8	33.3	11.5
	Deciduous shrubs	0.3	1.5	0.3	0.0	1.3	0.5	0.0	0.0	0.0
	Clubmosses	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Bryophytes	12.0	12.3	24.5	5.5	8.8	4.0	3.0	3.8	2.8
	Ferns	1.5	35.8	0.0	3.0	3.3	0.0	0.0	0.3	0.0
	Broadleaf Herbs	0.0	0.8	0.0	0.0	1.0	0.3	0.0	0.0	0.0
	Grasses/Sedges	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Leaf litter	91.8	96.0	91.8	97.8	94.8	96.3	94.3	96.3	95.0
	Boles	5.0	2.0	0.0	4.8	2.3	3.3	2.0	2.0	5.5
	Stems	5.0	4.0	3.3	2.0	5.5	2.5	5.0	5.5	5.0
	Sticks	21.5	13.3	28.8	30.5	36.0	29.5	19.5	24.5	14.0
	Bare Ground	0.0	0.0	0.0	0.0	0.0	2.0	4.0	0.0	0.0
	Bare Rock	0.3	1.0	0.3	2.0	8.0	1.5	6.3	6.8	1.3
	Live Tree Trunks	0.0	0.0	0.0	0.0	0.5	3.0	0.0	0.0	0.0

Appendix D. Continued.

Stratum	Cover Component	FH1	FH2	FH3	FX1	FX2	FX3
Supercanopy	Hemlock trees	0.0	0.0	0.0	0.0	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	0.0	0.0	14.3
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0
Canopy	Hemlock trees	18.8	47.8	67.5	80.5	33.8	55.8
	Hardwood trees	75.0	35.8	36.8	21.3	92.8	34.3
	Vines	0.0	0.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	1.0	0.0	0.0
Subcanopy	Hemlock trees	54.3	10.8	38.5	5.5	48.5	35.8
	Hardwood trees	2.5	40.5	0.8	7.3	0.0	2.8
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0
	Vines	0.0	0.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0
High Midstory	Hemlock trees	0.0	8.8	0.0	0.0	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	0.0	9.8	0.0
Low Midstory	Hemlock trees	0.0	12.0	23.3	0.0	21.5	13.0
	Hardwood trees	5.5	0.0	0.0	4.8	0.0	3.8
	Vines	0.0	0.0	0.0	0.0	0.0	0.0
	Evergreen shrubs	1.8	0.0	0.0	0.0	0.0	0.0
	Deciduous shrubs	0.0	0.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0
	Stems	0.0	0.0	0.0	0.0	2.3	0.0
	Sticks	0.0	0.0	0.0	0.0	0.0	0.0
Shrub Layer	Hemlock trees	0.3	20.5	0.3	14.0	3.8	0.0
	Hardwood trees	0.0	2.3	0.0	1.8	1.0	0.0
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0
	Vines	0.0	0.0	0.0	0.0	0.0	0.0
	Evergreen shrubs	35.5	29.8	28.8	0.0	0.0	0.0
	Deciduous shrubs	0.0	0.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0
	Stems	0.8	0.3	1.3	0.0	1.3	0.0
	Sticks	0.0	0.0	0.3	0.0	0.8	0.0
Uprooted Trees	Hemlock trees	2.8	0.0	0.0	0.0	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	0.0	0.0	0.0
Understory	Hemlock trees	1.8	27.8	1.8	8.0	9.0	0.0
	Hardwood trees	0.3	1.8	0.3	4.8	0.5	0.3
	Vines	0.3	0.5	0.0	0.8	2.0	1.3
	Evergreen shrubs	11.5	22.8	29.8	2.0	0.5	0.5
	Deciduous shrubs	0.0	0.0	0.0	0.0	0.0	0.0
	Clubmosses	0.0	0.0	0.0	0.0	0.0	0.0
	Bryophytes	0.0	2.0	1.0	2.0	0.0	0.0
	Ferns	0.0	0.3	0.0	0.0	0.0	0.0
	Broadleaf Herbs	0.5	0.8	0.0	1.5	0.0	0.0
	Grasses/Sedges	0.0	0.0	0.0	0.0	0.0	0.0
	Leaf litter	99.5	97.0	99.0	98.3	98.0	98.3
	Boles	1.5	0.8	3.8	1.0	0.0	1.0
	Stems	4.5	1.5	4.8	1.0	3.5	0.8
	Sticks	20.8	26.0	21.8	35.3	26.3	22.3
	Bare Ground	0.5	0.8	0.0	0.0	0.0	0.0
	Bare Rock	0.0	0.0	0.0	0.0	0.0	0.0
	Live Tree Trunks	0.0	1.5	0.0	3.3	0.8	2.0

Appendix D. Continued.

Stratum	Cover Component	WH1	WH2	WH3	WX1	WX2	WX3
Supercanopy	Hemlock trees	0.0	0.0	0.0	0.0	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	0.0	0.0	0.0
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0
Canopy	Hemlock trees	20.5	43.8	71.5	25.0	52.3	9.0
	Hardwood trees	53.3	74.3	7.0	68.0	73.3	84.3
	Vines	0.0	2.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0
Subcanopy	Hemlock trees	59.3	10.0	54.0	28.3	14.3	57.5
	Hardwood trees	7.5	11.5	21.8	20.8	0.0	6.5
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0
	Vines	0.0	0.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0
High Midstory	Hemlock trees	17.5	18.0	0.0	0.0	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	0.0	0.0	0.0
Low Midstory	Hemlock trees	2.3	0.0	0.0	23.3	12.3	13.0
	Hardwood trees	0.0	6.5	7.8	29.8	6.3	0.0
	Vines	0.0	2.0	0.0	0.0	0.0	0.0
	Evergreen shrubs	0.0	0.0	0.0	0.0	0.0	0.0
	Deciduous shrubs	0.0	0.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	0.8	0.0	0.0
	Stems	0.0	0.0	0.0	0.0	0.0	0.0
	Sticks	0.0	0.0	0.0	0.0	0.0	0.8
Shrub Layer	Hemlock trees	0.0	0.0	0.0	18.3	11.5	11.8
	Hardwood trees	0.0	0.0	0.0	0.0	6.0	0.0
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0
	Vines	0.0	0.0	0.0	0.0	1.0	0.0
	Evergreen shrubs	25.5	26.5	44.0	0.0	0.0	7.5
	Deciduous shrubs	0.0	0.0	0.0	0.0	1.0	0.0
	Boles	1.3	0.0	0.0	0.0	0.0	0.0
	Stems	0.5	0.0	0.0	0.0	0.0	0.0
	Sticks	1.0	0.8	0.5	0.0	0.0	0.0
Uprooted Trees	Hemlock trees	0.0	0.0	0.0	0.0	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	0.0	0.0	0.0
Understory	Hemlock trees	1.8	0.0	0.0	0.0	0.0	0.8
	Hardwood trees	0.0	0.0	0.5	6.3	7.3	0.3
	Vines	0.0	0.0	0.0	0.3	0.5	1.3
	Evergreen shrubs	45.0	57.0	46.0	0.0	1.3	3.5
	Deciduous shrubs	0.0	0.0	0.0	0.3	2.3	0.0
	Clubmosses	0.0	0.0	0.0	0.0	0.0	0.0
	Bryophytes	1.5	2.3	2.3	0.8	0.3	0.0
	Ferns	0.0	0.3	0.0	0.0	0.3	0.0
	Broadleaf Herbs	0.0	0.0	0.0	2.0	0.0	0.3
	Grasses/Sedges	0.0	0.0	0.0	0.0	0.0	0.0
	Leaf litter	97.5	74.0	98.0	97.3	100.0	98.3
	Boles	1.0	1.0	0.0	2.5	0.8	5.0
	Stems	3.5	4.5	6.8	1.3	1.8	0.3
	Sticks	33.3	21.3	23.5	19.5	15.5	18.8
	Bare Ground	0.0	0.0	0.0	0.0	0.0	0.0
	Bare Rock	0.0	0.5	0.0	0.0	0.0	0.0
	Live Tree Trunks	2.5	0.8	0.0	2.5	0.0	0.8

Appendix D. Continued.

Stratum	Cover Component	GM1	GM2	GM3	KM1	KM2	KM3
Supercanopy	Hemlock trees	0.0	0.0	0.0	0.0	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	0.0	0.0	0.0
	Pine trees	0.0	27.0	0.0	0.0	0.0	0.0
Canopy	Hemlock trees	0.0	0.0	0.0	17.0	0.0	4.8
	Hardwood trees	58.3	56.5	98.3	61.3	77.3	76.0
	Vines	3.3	0.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0
Subcanopy	Hemlock trees	62.3	37.0	65.8	46.8	69.8	70.5
	Hardwood trees	51.5	23.8	13.3	34.8	41.8	11.8
	Pine trees	0.0	0.0	0.0	0.0	0.0	0.0
	Vines	4.8	0.0	0.0	0.0	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0
High Midstory	Hemlock trees	0.0	13.0	0.0	0.0	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	0.0	0.0	0.0
Low Midstory	Hemlock trees	2.8	23.3	13.8	43.3	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	0.0	4.3	19.8
	Vines	0.0	0.0	0.0	0.0	0.0	0.0
	Evergreen shrubs	0.0	0.0	0.0	0.0	0.0	0.0
	Deciduous shrubs	0.0	0.0	0.0	3.5	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0
	Stems	0.0	0.0	0.0	0.0	0.0	0.0
	Sticks	0.0	0.0	0.0	0.0	0.0	0.0
Shrub Layer	Hemlock trees	1.8	0.0	0.0	14.5	0.0	5.5
	Hardwood trees	0.0	0.0	6.3	0.0	6.8	0.0
	Pine trees	0.0	0.0	0.0	2.3	0.0	0.0
	Vines	0.0	0.0	0.0	0.0	0.0	0.0
	Evergreen shrubs	30.3	11.8	8.0	10.8	0.0	0.0
	Deciduous shrubs	0.0	0.0	0.0	1.5	0.0	0.0
	Boles	0.0	0.0	0.0	0.0	0.0	0.0
	Stems	0.3	0.0	0.0	0.0	0.0	0.0
	Sticks	0.0	0.0	0.0	0.0	0.0	0.5
Uprooted Trees	Hemlock trees	0.0	0.0	0.0	0.0	0.0	0.0
	Hardwood trees	0.0	0.0	0.0	0.0	0.0	0.0
Understory	Hemlock trees	0.0	0.0	0.0	7.3	1.3	0.0
	Hardwood trees	3.8	1.5	1.0	0.5	1.3	0.0
	Vines	3.0	0.5	0.0	0.5	0.0	0.0
	Evergreen shrubs	0.0	0.5	0.0	0.5	0.8	0.0
	Deciduous shrubs	0.8	0.0	1.5	0.0	0.3	0.0
	Clubmosses	0.0	0.0	0.0	0.0	0.0	0.0
	Bryophytes	2.0	0.5	2.3	2.0	1.8	0.0
	Ferns	0.8	1.3	3.3	0.3	3.8	0.0
	Broadleaf Herbs	3.3	0.3	1.5	0.3	2.0	0.0
	Grasses/Sedges	0.0	0.0	0.0	0.0	0.0	0.0
	Leaf litter	99.3	100.0	96.8	97.8	95.0	97.3
	Boles	4.0	0.3	3.0	4.8	6.8	1.8
	Stems	2.3	3.8	5.5	3.8	3.3	2.0
	Sticks	11.5	9.8	9.5	12.8	10.0	9.3
	Bare Ground	0.5	0.3	1.5	0.0	0.3	0.0
	Bare Rock	2.0	0.0	0.0	0.0	0.0	0.0
	Live Tree Trunks	0.5	1.0	3.0	0.0	0.0	1.5

Appendix E. Combined total cover (%) for all strata, and cover (%) and minimum-maximum heights (m) of hemlocks, hardwoods, pines, and shrubs separated into vertical strata on four 10 m line-transects per plot in July, 1999. Vertical stratification occurred whenever live foliage of a species or group in the "assigned" stratum overlapped with other strata, and is indicated by a box surrounding the stratified cover and height values. The first character of the plot code represents the geographic location: F= Fayetteville, W= Wolf Creek, K= Kates Branch, G= Grandview, M= Meadow River, and C= Carnifex Ferry State Park. The second character equates with the principle study design, which consists of 3 levels along a moisture gradient; H= Hydric, M= Mesic, and X= Xeric. The third character is replication number. Transect number follows the dash.

					Vertical Stratification of Cover and Height values						
Plot - Transect	**Species / Group**	**Assigned Stratum**		**Total Cover**	**Super-canopy**	**Canopy**	**Sub-canopy**	**High Midstory**	**Low Midstory**	**Shrub Layer**	**Under-story**
CH1-1	Hemlock trees	Canopy	Cover	98	0	98	0	0	0	0	0
			Heights			15-30					
		Low Midstory	Cover	25	0	0	0	0	25	0	0
			Heights						3-3.5		
	Hardwood trees	Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	25	0	0	0	0	0	25	0
			Heights							1.4-3.5	
		Understory	Cover	18	0	0	0	0	0	0	18
			Heights								0-1.4
CH1-2	Hemlock trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			10-30					
		Shrub Layer	Cover	3	0	0	0	0	0	3	0
			Heights							1.4-4.5	
	Hardwood trees	Supercanopy	Cover	21	21	0	0	0	0	0	0
			Heights		30-35						
		Shrub Layer	Cover	50	0	0	0	0	0	50	0
			Heights							1.4-4.5	
	Evergreen shrubs	Shrub Layer	Cover	52	0	0	0	0	0	52	0
			Heights							1.4-4.5	
		Understory	Cover	42	0	0	0	0	0	0	42
			Heights								0-1.4
CH1-3	Hemlock trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			20-30					
		Shrub Layer	Cover	7	0	0	0	0	0	7	0
			Heights							1.8-3	
	Hardwood trees	Subcanopy	Cover	48	0	0	48	0	0	0	0
			Heights				15-25				
		Uprooted	Cover	12	0	0	0	0	0	12	0
			Heights							2-2.5	
	Evergreen shrubs	Shrub Layer	Cover	83	0	0	0	0	0	83	0
			Heights							1.4-7	
		Understory	Cover	33	0	0	0	0	0	0	33
			Heights								0-1.4
CH1-4	Hemlock trees	Canopy	Cover	40	0	40	0	0	0	0	0
			Heights			20-30					
		Shrub Layer	Cover	6	0	0	0	0	0	6	1
			Heights							2-3.5	0-1.4
		Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4
	Hardwood trees	High Midstory	Cover	51	0	0	0	51	0	0	0
			Heights					5-13			

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Shrub Layer	Cover	5	0	0	0	0	0	5	0
			Heights							2-3	
		Understory	Cover	4	0	0	0	0	0	0	4
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	52	0	0	0	0	0	52	0
			Heights							1.4-5	
		Understory	Cover	48	0	0	0	0	0	0	48
			Heights								0-1.4
CH2-1	Hemlock trees	Canopy	Cover	76	0	76	0	0	0	0	0
			Heights			20-30					
		Low Midstory	Cover	26	0	0	0	0	20	0	6
			Heights						2-4.5		0-1.4
	Hardwood trees	Subcanopy	Cover	29	0	0	29	0	0	0	0
			Heights				18-25				
		Understory	Cover	9	0	0	0	0	0	0	9
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	51	0	0	0	0	0	51	0
			Heights							1.4-3.5	
		Understory	Cover	23	0	0	0	0	0	0	23
			Heights								0-1.4
CH2-2	Hemlock trees	Canopy	Cover	46	0	46	0	0	0	0	0
			Heights			20-30					
	Hardwood trees	Subcanopy	Cover	25	0	0	25	0	0	0	0
			Heights				15-25				
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Understory	Cover	33	0	0	0	0	0	0	33
			Heights								0-1.4
CH2-3	Hemlock trees	Canopy	Cover	7	0	7	0	0	0	0	0
			Heights			20-30					
		Subcanopy	Cover	91	0	0	91	0	0	0	0
			Heights				15-25				
		Low Midstory	Cover	22	0	0	0	0	22	8	0
			Heights						2.5-5	1.4-2.5	
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
	Hardwood trees	Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	22	0	0	0	0	0	22	0
			Heights							1.4-2.5	
		Understory	Cover	61	0	0	0	0	0	0	61
			Heights								0-1.4
CH2-4	Hemlock trees	Canopy	Cover	76	0	76	0	0	0	0	0
			Heights			20-30					
		Low Midstory	Cover	18	0	0	0	0	11	12	5
			Heights						3-5	1.4-3	0-1.4

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
	Hardwood trees	Understory	Cover	10	0	0	0	0	0	0	10
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	55	0	0	0	0	0	55	0
			Heights							1.4-3	
		Understory	Cover	57	0	0	0	0	0	0	57
			Heights								0-1.4
CH3-1	Hemlock trees	Canopy	Cover	51	0	51	0	0	0	0	0
			Heights			15-25					
	Evergreen shrubs	Shrub Layer	Cover	65	0	0	0	0	0	65	0
			Heights							1.4-4	
		Understory	Cover	75	0	0	0	0	0	0	75
			Heights								0-1.4
CH3-2	Hemlock trees	Canopy	Cover	31	0	31	0	0	0	0	0
			Heights			15-25					
		Understory	Cover	10	0	0	0	0	0	0	10
			Heights								0-1.4
	Hardwood trees	Subcanopy	Cover	16	0	0	16	0	0	0	0
			Heights				15-20				
		Shrub Layer	Cover	9	0	0	0	0	0	9	0
			Heights							1.4-3.5	
	Evergreen shrubs	Shrub Layer	Cover	68	0	0	0	0	0	68	0
			Heights							1.4-3.5	
		Understory	Cover	60	0	0	0	0	0	0	60
			Heights								0-1.4
CH3-3	Hemlock trees	Canopy	Cover	74	0	74	0	0	0	0	0
			Heights			15-25					
		Subcanopy	Cover	10	0	0	10	0	0	0	0
			Heights				10-17				
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Hardwood trees	Subcanopy	Cover	31	0	0	31	0	0	0	0
			Heights				10-15				
		Shrub Layer	Cover	22	0	0	0	0	0	22	0
			Heights							1.4-4.5	
	Evergreen shrubs	Shrub Layer	Cover	41	0	0	0	0	0	41	0
			Heights							1.4-4.5	
		Understory	Cover	82	0	0	0	0	0	0	82
			Heights								0-1.4
CH3-4	Hemlock trees	Canopy	Cover	17	0	17	0	0	0	0	0
			Heights			15-25					
	Hardwood trees	Subcanopy	Cover	64	0	0	64	0	0	0	0
			Heights				12-20				
		Low Midstory	Cover	11	0	0	0	0	11	0	0
			Heights						6-12		
	Evergreen shrubs	Shrub Layer	Cover	60	0	0	0	0	0	60	0
			Heights							1.4-3.5	

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Understory	Cover	62	0	0	0	0	0	0	62
			Heights								0-1.4
CM1-1	Hemlock trees	Subcanopy	Cover	95	0	0	95	0	0	44	0
			Heights				3-18			2.5-3	
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			20-25					
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
CM1-2	Hemlock trees	Subcanopy	Cover	31	0	0	31	0	0	0	0
			Heights				4-18				
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			20-25					
		Subcanopy	Cover	60	0	0	60	0	0	0	0
			Heights				15-18				
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
CM1-3	Hemlock trees	Subcanopy	Cover	77	0	0	77	0	0	0	0
			Heights				8-18				
	Hardwood trees	Canopy	Cover	90	0	90	0	0	0	0	0
			Heights			18-25					
	Evergreen shrubs	Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Deciduous shrubs	Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
CM1-4	Hemlock trees	Subcanopy	Cover	96	0	0	96	0	0	5	0
			Heights				3.5-18			2-3.5	
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			20-25					
		Subcanopy	Cover	17	0	0	17	0	0	0	0
			Heights				15-18				
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
CM2-1	Hemlock trees	Subcanopy	Cover	93	0	0	93	0	0	25	0
			Heights				5-20			2-2.5	
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			20-25					
CM2-2	Hemlock trees	Subcanopy	Cover	65	0	0	65	0	0	0	0
			Heights				5-20				
		Low Midstory	Cover	27	0	0	0	0	27	0	0
			Heights						3.5-5		
	Hardwood trees	Canopy	Cover	92	0	92	0	0	0	0	0
			Heights			20-25					
CM2-3	Hemlock trees	Canopy	Cover	55	0	55	0	0	15	0	0
			Heights			6-25			4-4.1		

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Shrub Layer	Cover	25	0	0	0	0	0	18	7
			Heights							2.5-4	0-1.4
	Hardwood trees	Canopy	Cover	82	0	82	0	0	0	0	0
			Heights			20-25					
		Shrub Layer	Cover	18	0	0	0	0	0	18	0
			Heights							2.5-4	
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
CM2-4	Hemlock trees	Subcanopy	Cover	23	0	0	23	0	0	0	0
			Heights				10-20				
		Shrub Layer	Cover	35	0	0	0	0	0	35	0
			Heights							1.4-3.5	
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-25					
		Subcanopy	Cover	90	0	0	63	0	27	0	0
			Heights				6-20		3.5-5		
CM3-1	Hemlock trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			4-20					
		Shrub Layer	Cover	7	0	0	0	0	0	4	3
			Heights							1.4-3	0-1.4
	Hardwood trees	Canopy	Cover	57	0	57	0	0	0	0	0
			Heights			10-20					
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	16	0	0	0	0	0	16	0
			Heights							1.4-3	
		Understory	Cover	10	0	0	0	0	0	0	10
			Heights								0-1.4
CM3-2	Hemlock trees	Supercanopy	Cover	100	100	0	0	0	0	0	0
			Heights		3.5-23						
	Hardwood trees	Canopy	Cover	34	0	34	0	0	0	0	0
			Heights			10-20					
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	7	0	0	0	0	0	7	0
			Heights							1.4-2.5	
		Understory	Cover	8	0	0	0	0	0	0	8
			Heights								0-1.4
CM3-3	Hemlock trees	Canopy	Cover	54	0	54	0	0	0	0	0
			Heights			6-20					
	Hardwood trees	Canopy	Cover	91	0	91	0	0	0	0	0
			Heights			10-20					
	Evergreen shrubs	Shrub Layer	Cover	28	0	0	0	0	0	28	0
			Heights							1.4-3.5	
		Understory	Cover	30	0	0	0	0	0	0	30
			Heights								0-1.4

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
CM3-4	Hemlock trees	Canopy	Cover	5	0	5	0	0	0	0	0
			Heights			8-8.5					
		Low Midstory	Cover	90	0	0	0	0	90	0	0
			Heights						3.5-12		
	Hardwood trees	Supercanopy	Cover	100	100	0	0	0	0	0	0
			Heights		20-27						
		Low Midstory	Cover	54	0	0	0	0	54	0	0
			Heights						10-12		
		Shrub Layer	Cover	28	0	0	0	0	0	28	0
			Heights							1.4-2.5	
	Evergreen shrubs	Shrub Layer	Cover	10	0	0	0	0	0	10	0
			Heights							1.4-2.5	
		Understory	Cover	43	0	0	0	0	0	0	43
			Heights								0-1.4
CX1-1	Hemlock trees	Subcanopy	Cover	75	0	0	75	0	22	0	2
			Heights				8-15		1.4-8		0.5-1.4
		Low Midstory	Cover	1	0	0	0	0	1	0	0
			Heights						1.4-6		
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			10-20					
		Low Midstory	Cover	16	0	0	0	0	16	0	0
			Heights						6-8		
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
CX1-2	Hemlock trees	Subcanopy	Cover	67	0	0	67	0	0	0	10
			Heights				1.4-18				0-1.4
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-25					
		Subcanopy	Cover	24	0	0	24	0	0	0	0
			Heights				7-10				
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
CX1-3	Hemlock trees	Subcanopy	Cover	82	0	0	82	35	0	0	0
			Heights				11-18	7-11			
		Low Midstory	Cover	35	0	0	0	0	35	0	7
			Heights						1.4-7		0.2-1.4
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Hardwood trees	High Midstory	Cover	11	0	0	0	11	0	0	0
			Heights					8-11			
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
	Pine trees	Subcanopy	Cover	10	0	0	10	0	0	0	0
			Heights				13-15				
CX1-4	Hemlock trees	Subcanopy	Cover	55	0	0	48	36	0	22	0
			Heights				5-15	2-5		1.4-2	

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Shrub Layer	Cover	15	0	0	0	0	0	10	8
			Heights							1.4-2	0.5-1.4
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-25					
		High Midstory	Cover	39	0	0	0	39	0	0	0
			Heights					5-12			
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
CX2-1	Hemlock trees	Subcanopy	Cover	56	0	0	53	0	26	0	0
			Heights				8-20		3-6		
		Low Midstory	Cover	16	0	0	0	0	16	0	6
			Heights						1.4-8		0.8-1.4
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-28					
		Subcanopy	Cover	8	0	0	7	0	1	0	0
			Heights				10-15		1.4-8		
CX2-2	Hemlock trees	Subcanopy	Cover	37	0	0	37	0	0	0	0
			Heights				10-20				
		Low Midstory	Cover	66	0	0	0	0	66	0	0
			Heights						3-10		
	Hardwood trees	Canopy	Cover	81	0	81	0	0	0	0	0
			Heights			15-28					
		Subcanopy	Cover	70	0	0	70	0	0	0	0
			Heights				15-20				
CX2-3	Hemlock trees	Subcanopy	Cover	60	0	0	60	0	0	0	0
			Heights				8-22				
		Shrub Layer	Cover	73	0	0	0	0	0	73	0
			Heights							3-6	
	Hardwood trees	Canopy	Cover	29	0	29	0	0	0	0	0
			Heights			15-28					
		Subcanopy	Cover	41	0	0	41	0	0	0	0
			Heights				15-20				
CX2-4	Hemlock trees	Subcanopy	Cover	21	0	0	21	0	0	0	0
			Heights				10-22				
		Low Midstory	Cover	29	0	0	0	0	29	0	0
			Heights						2-12		
	Hardwood trees	Canopy	Cover	95	0	95	0	0	0	0	0
			Heights			15-28					
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
CX3-1	Hemlock trees	Subcanopy	Cover	100	0	0	100	0	0	0	0
			Heights				7-20				
	Hardwood trees	Canopy	Cover	90	0	90	0	0	0	0	0
			Heights			20-25					
CX3-2	Hemlock trees	Subcanopy	Cover	76	0	0	76	0	0	0	0
			Heights				6-20				

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			20-25					
		Uprooted	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
CX3-3	Hemlock trees	Subcanopy	Cover	97	0	0	97	0	0	0	0
			Heights				7-20				
		Low Midstory	Cover	19	0	0	0	0	19	0	0
			Heights						1.4-3		
	Hardwood trees	Canopy	Cover	17	0	17	0	0	0	0	0
			Heights			20-25					
CX3-4	Hemlock trees	Subcanopy	Cover	90	0	0	90	0	0	0	0
			Heights				6-20				
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			20-28					
		Subcanopy	Cover	2	0	0	2	0	0	0	0
			Heights				7-9				
FH1-1	Hemlock trees	Subcanopy	Cover	17	0	0	17	0	0	0	0
			Heights				5-12				
	Hardwood trees	Canopy	Cover	51	0	51	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	10	0	0	10	0	0	0	0
			Heights				6-10				
	Evergreen shrubs	Low Midstory	Cover	7	0	0	0	0	7	0	0
			Heights						3-3.5		
		Shrub Layer	Cover	35	0	0	0	0	0	35	0
			Heights							1.4-3.5	
		Understory	Cover	64	0	0	0	0	0	0	64
			Heights								0-1.4
FH1-2	Hemlock trees	Canopy	Cover	75	0	75	0	0	0	0	0
			Heights			5-20					
		Uprooted	Cover	11	0	0	0	0	0	0	11
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	59	0	59	0	0	0	0	0
			Heights			16-20					
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	43	0	0	0	0	0	43	0
			Heights							1.4-3.5	
		Understory	Cover	40	0	0	0	0	0	0	40
			Heights								0-1.4
FH1-3	Hemlock trees	Subcanopy	Cover	100	0	0	100	0	18	0	0
			Heights				5-20		3-3.5		
		Shrub Layer	Cover	1	0	0	0	0	0	1	0
			Heights							1.4-3	

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Understory	Cover	7	0	0	0	0	0	0	7
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	90	0	90	0	0	0	0	0
			Heights			18-25					
		Low Midstory	Cover	22	0	0	0	0	22	0	0
			Heights						3.5-4.5		
	Evergreen shrubs	Shrub Layer	Cover	45	0	0	0	0	0	45	0
			Heights							1.4-3	
		Understory	Cover	56	0	0	0	0	0	0	56
			Heights								0-1.4
FH1-4	Hemlock trees	Subcanopy	Cover	100	0	0	100	0	0	0	0
			Heights				5-20				
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			20-25					
	Evergreen shrubs	Shrub Layer	Cover	55	0	0	0	0	0	55	0
			Heights							1.4-3.5	
		Understory	Cover	21	0	0	0	0	0	0	21
			Heights								0-1.4
FH2-1	Hemlock trees	Low Midstory	Cover	48	0	0	0	0	39	23	0
			Heights						3-5	1.4-3	
		Shrub Layer	Cover	11	0	0	0	0	0	11	0
			Heights							1.4-3	
		Understory	Cover	37	0	0	0	0	0	0	37
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	67	0	67	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	85	0	0	85	0	0	0	0
			Heights				5-15				
		Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	42	0	0	0	0	0	42	0
			Heights							1.4-3	
		Understory	Cover	38	0	0	0	0	0	0	38
			Heights								0-1.4
FH2-2	Hemlock trees	Canopy	Cover	91	0	91	0	0	0	0	0
			Heights			15-20					
		Shrub Layer	Cover	22	0	0	0	0	0	22	0
			Heights							1.4-3.5	
		Understory	Cover	9	0	0	0	0	0	0	9
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	24	0	24	0	0	0	0	0
			Heights			13-20					
		Subcanopy	Cover	20	0	0	20	0	0	0	0
			Heights				8-15				
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
	Evergreen shrubs	Shrub Layer	Cover	19	0	0	0	0	0	19	0
			Heights							1.4-3.5	
		Understory	Cover	25	0	0	0	0	0	0	25
			Heights								0-1.4
FH2-3	Hemlock trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			10-20					
		Subcanopy	Cover	43	0	0	43	0	0	0	0
			Heights				3-10				
		Understory	Cover	19	0	0	0	0	0	0	19
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	7	0	7	0	0	0	0	0
			Heights			16-20					
		Shrub Layer	Cover	9	0	0	0	0	0	9	0
			Heights							1.4-2.5	
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	32	0	0	0	0	0	32	0
			Heights							1.4-2.5	
		Understory	Cover	16	0	0	0	0	0	0	16
			Heights								0-1.4
FH2-4	Hemlock trees	High Midstory	Cover	35	0	0	0	35	0	0	0
			Heights					5-10			
		Shrub Layer	Cover	49	0	0	0	0	0	49	0
			Heights							1.4-2.5	
		Understory	Cover	46	0	0	0	0	0	0	46
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	45	0	45	0	0	0	0	0
			Heights			10-20					
		Subcanopy	Cover	57	0	0	57	3	0	0	0
			Heights				10-15	9-10			
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	26	0	0	0	0	0	26	0
			Heights							1.4-3.5	
		Understory	Cover	26	0	0	0	0	0	0	26
			Heights								0-1.4
FH3-1	Hemlock trees	Subcanopy	Cover	58	0	0	58	0	0	0	0
			Heights				10-20				
		Low Midstory	Cover	93	0	0	0	0	93	0	0
			Heights						3-5		
	Hardwood trees	Canopy	Cover	95	0	95	0	0	0	0	0
			Heights			18-22					
	Evergreen shrubs	Shrub Layer	Cover	31	0	0	0	0	0	31	0
			Heights							1.4-3	
		Understory	Cover	30	0	0	0	0	0	0	30
			Heights								0-1.4

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
FH3-2	Hemlock trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			20-25					
		Subcanopy	Cover	46	0	0	46	0	0	0	0
			Heights				6-20				
	Evergreen shrubs	Shrub Layer	Cover	57	0	0	0	0	0	57	0
			Heights							1.4-4.5	
		Understory	Cover	32	0	0	0	0	0	0	32
			Heights								0-1.4
FH3-3	Hemlock trees	Canopy	Cover	72	0	72	0	0	0	0	0
			Heights			12-25					
		Subcanopy	Cover	40	0	0	40	0	0	0	0
			Heights				10-20				
		Understory	Cover	7	0	0	0	0	0	0	7
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	39	0	39	0	0	0	0	0
			Heights			15-25					
		Subcanopy	Cover	3	0	0	3	0	0	0	0
			Heights				15-17				
	Evergreen shrubs	Shrub Layer	Cover	20	0	0	0	0	0	20	0
			Heights							1.4-4	
		Understory	Cover	35	0	0	0	0	0	0	35
			Heights								0-1.4
FH3-4	Hemlock trees	Canopy	Cover	98	0	98	0	0	0	0	0
			Heights			20-25					
		Subcanopy	Cover	10	0	0	10	0	0	0	0
			Heights				12-20				
		Shrub Layer	Cover	1	0	0	0	0	0	1	0
			Heights							1.4-1.6	
	Hardwood trees	Canopy	Cover	13	0	10	3	0	0	0	0
			Heights			20-25	12-20				
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	7	0	0	0	0	0	7	0
			Heights							1.4-1.6	
		Understory	Cover	22	0	0	0	0	0	0	22
			Heights								0-1.4
FX1-1	Hemlock trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-25					
FX1-2	Hemlock trees	Canopy	Cover	47	0	47	0	0	0	0	0
			Heights			15-25					
		Subcanopy	Cover	22	0	0	22	0	0	0	0
			Heights				15-20				
		Shrub Layer	Cover	13	0	0	0	0	0	13	8
			Heights							1.4-2.5	0-1.4
	Hardwood trees	Canopy	Cover	50	0	50	0	0	0	0	0
			Heights			20-25					

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Subcanopy	Cover	29	0	0	29	0	0	0	0
			Heights				18-20				
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
FX1-3	Hemlock trees	Canopy	Cover	80	0	80	0	0	0	0	0
			Heights			15-25					
		Shrub Layer	Cover	43	0	0	0	0	0	36	38
			Heights							1.4-2.5	0-1.4
		Understory	Cover	32	0	0	0	0	0	0	32
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	35	0	35	0	0	0	0	0
			Heights			22-25					
		Low Midstory	Cover	2	0	0	0	0	2	0	0
			Heights						2-4		
		Understory	Cover	16	0	0	0	0	0	0	16
			Heights								0-1.4
FX1-4	Hemlock trees	Canopy	Cover	95	0	95	0	0	0	0	0
			Heights			20-25					
	Hardwood trees	Low Midstory	Cover	17	0	0	0	0	17	0	0
			Heights						2-4		
		Shrub Layer	Cover	7	0	0	0	0	0	7	0
			Heights							1.4-1.6	
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Understory	Cover	8	0	0	0	0	0	0	8
			Heights								0-1.4
FX2-1	Hemlock trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			5-20					
		Low Midstory	Cover	11	0	0	0	0	11	0	0
			Heights						2-4.5		
		Understory	Cover	5	0	0	0	0	0	0	5
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-20					
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
FX2-2	Hemlock trees	Canopy	Cover	35	0	10	35	0	0	0	0
			Heights			10-20	5-6				
		Subcanopy	Cover	60	0	0	60	0	0	0	0
			Heights				2.5-12				
		Shrub Layer	Cover	15	0	0	0	0	0	15	0
			Heights							1.4-2.5	
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			12-20					
	Evergreen shrubs	Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
FX2-3	Hemlock trees	Subcanopy	Cover	42	0	0	3	0	42	0	0
			Heights				8-10		2.5-3		
		Low Midstory	Cover	49	0	0	0	0	44	0	35
			Heights						1.6-3		0-1.4
		Understory	Cover	31	0	0	0	0	0	0	31
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			10-25					
		High Midstory	Cover	39	0	0	0	39	0	0	0
			Heights					4-8			
		Shrub Layer	Cover	4	0	0	0	0	0	4	0
			Heights							1.4-1.6	
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
FX2-4	Hemlock trees	Subcanopy	Cover	92	0	0	92	0	5	0	0
			Heights				4-10		2-2.1		
		Low Midstory	Cover	26	0	0	0	0	26	0	0
			Heights						1.4-3		
	Hardwood trees	Canopy	Cover	71	0	71	0	0	0	0	0
			Heights			10-20					
FX3-1	Hemlock trees	Canopy	Cover	17	0	17	0	0	0	0	0
			Heights			15-23					
		Subcanopy	Cover	61	0	0	59	2	0	0	0
			Heights				12-15	5-5.1			
		Low Midstory	Cover	20	0	0	0	0	20	0	0
			Heights						3-5		
	Hardwood trees	Canopy	Cover	74	0	74	0	0	0	0	0
			Heights			15-20					
FX3-2	Hemlock trees	Canopy	Cover	56	0	56	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	82	0	0	82	0	0	0	0
			Heights				10-15				
	Hardwood trees	Supercanopy	Cover	57	57	0	0	0	0	0	0
			Heights		15-25						
FX3-3	Hemlock trees	Canopy	Cover	50	0	50	0	0	0	0	0
			Heights			15-20					
		Low Midstory	Cover	31	0	0	0	0	31	0	15
			Heights						1.4-3		0.5-1.4
	Hardwood trees	Canopy	Cover	63	0	63	0	0	0	0	0
			Heights			8-20					
		Low Midstory	Cover	10	0	0	0	0	10	0	8
			Heights						2-5		0-1.4
	Evergreen shrubs	Understory	Cover	6	0	0	0	0	0	0	6
			Heights								0-1.4
FX3-4	Hemlock trees	Canopy	Cover	100	0	100	0	0	16	0	0
			Heights			10-25			1.4-3.5		

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Low Midstory	Cover	1	0	0	0	0	1	0	0
			Heights						1.4-2		
	Hardwood trees	Subcanopy	Cover	11	0	0	11	0	0	0	0
			Heights				10-20				
		Low Midstory	Cover	5	0	0	0	0	5	0	0
			Heights						1.4-2.5		
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
GM1-1	Hemlock trees	Subcanopy	Cover	63	0	0	63	0	0	0	0
			Heights				5-20				
	Hardwood trees	Canopy	Cover	48	0	48	0	0	0	0	0
			Heights			15-25					
		Subcanopy	Cover	29	0	0	29	0	0	5	0
			Heights				15-20			3-4	
	Evergreen shrubs	Shrub Layer	Cover	51	0	0	0	0	0	51	0
			Heights							2-4	
GM1-2	Hemlock trees	Subcanopy	Cover	35	0	0	35	0	0	20	0
			Heights				4-15			3.5-4	
		Shrub Layer	Cover	7	0	0	0	0	0	7	0
			Heights							1.4-4	
	Hardwood trees	Canopy	Cover	44	0	44	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	35	0	0	35	0	0	0	0
			Heights				10-17				
		Understory	Cover	6	0	0	0	0	0	0	6
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	18	0	0	0	0	0	18	0
			Heights							1.4-4	
GM1-3	Hemlock trees	Subcanopy	Cover	55	0	0	55	0	0	23	0
			Heights				3-12			2-3	
	Hardwood trees	Canopy	Cover	47	0	47	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	83	0	0	83	0	0	0	0
			Heights				10-14				
		Understory	Cover	6	0	0	0	0	0	0	6
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	28	0	0	0	0	0	28	0
			Heights							1.4-3	
	Deciduous shrubs	Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4
GM1-4	Hemlock trees	Subcanopy	Cover	96	0	0	82	0	14	0	0
			Heights				7-20		5-7		
		Low Midstory	Cover	11	0	0	0	0	11	0	0
			Heights						3-7		
	Hardwood trees	Canopy	Cover	94	0	94	0	0	0	0	0
			Heights			15-25					

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Subcanopy	Cover	59	0	0	59	0	0	0	0
			Heights				12-20				
		Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	24	0	0	0	0	0	24	0
			Heights							1.4-4	
GM2-1	Hemlock trees	Subcanopy	Cover	100	0	0	100	0	0	0	0
			Heights				2-20				
	Hardwood trees	Canopy	Cover	47	0	47	0	0	0	0	0
			Heights			20-25					
		Subcanopy	Cover	6	0	0	6	0	0	0	0
			Heights				15-20				
	Pine trees	Supercanopy	Cover	56	56	0	0	0	0	0	0
			Heights		25-30						
GM2-2	Hemlock trees	Subcanopy	Cover	48	0	0	48	0	0	0	0
			Heights				1.4-12				
	Hardwood trees	Canopy	Cover	53	0	53	0	0	0	0	0
			Heights			20-30					
		Subcanopy	Cover	43	0	0	43	0	0	0	0
			Heights				8-12				
		Understory	Cover	4	0	0	0	0	0	0	4
			Heights								0-1.4
	Pine trees	Supercanopy	Cover	28	28	0	0	0	0	0	0
			Heights		25-30						
GM2-3	Hemlock trees	High Midstory	Cover	52	0	0	0	49	0	37	0
			Heights					3-15		2-3	
	Hardwood trees	Canopy	Cover	33	0	33	0	0	0	0	0
			Heights			15-30					
		Subcanopy	Cover	46	0	0	46	0	0	0	0
			Heights				15-20				
	Pine trees	Supercanopy	Cover	24	24	0	0	0	0	0	0
			Heights		20-30						
	Evergreen shrubs	Shrub Layer	Cover	39	0	0	0	0	0	39	0
			Heights							1.4-3	
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
GM2-4	Hemlock trees	Low Midstory	Cover	93	0	0	0	0	85	31	0
			Heights						3-10	2-3	
	Hardwood trees	Canopy	Cover	93	0	93	0	0	0	0	0
			Heights			20-30					
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	8	0	0	0	0	0	8	0
			Heights							1.4-3	
GM3-1	Hemlock trees	Low Midstory	Cover	55	0	0	0	0	55	0	12
			Heights						2.5-10		0.5-1.4

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			25-30					
		Subcanopy	Cover	35	0	0	35	0	0	0	0
			Heights				5-15				
		Shrub Layer	Cover	25	0	0	0	0	0	25	0
			Heights							2-2.5	
		Understory	Cover	4	0	0	0	0	0	0	4
			Heights								0-1.4
	Deciduous shrubs	Understory	Cover	6	0	0	0	0	0	0	6
			Heights								0-1.4
GM3-2	Hemlock trees	Subcanopy	Cover	72	0	0	72	0	0	0	0
			Heights				3-12				
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-25					
	Evergreen shrubs	Shrub Layer	Cover	24	0	0	0	0	0	24	0
			Heights							1.4-3	
GM3-3	Hemlock trees	Subcanopy	Cover	91	0	0	91	0	0	0	0
			Heights				3.5-15				
	Hardwood trees	Canopy	Cover	93	0	93	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	6	0	0	6	0	0	0	0
			Heights				12-15				
	Evergreen shrubs	Shrub Layer	Cover	8	0	0	0	0	0	8	0
			Heights							1.8-3	
GM3-4	Hemlock trees	Subcanopy	Cover	100	0	0	100	0	0	0	0
			Heights				5-15				
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-25					
		Subcanopy	Cover	12	0	0	12	0	0	0	0
			Heights				12-15				
KM1-1	Hemlock trees	Canopy	Cover	68	0	68	0	0	0	0	0
			Heights			10-15					
		Subcanopy	Cover	100	0	0	100	0	0	0	2
			Heights				3-10				0.5-1.4
		Shrub Layer	Cover	2	0	0	0	0	0	2	0
			Heights							1.4-1.8	
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
	Hardwood trees	Subcanopy	Cover	38	0	0	38	0	0	0	0
			Heights				8-10				
	Evergreen shrubs	Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
KM1-2	Hemlock trees	Low Midstory	Cover	65	0	0	0	0	65	7	0
			Heights						5-10	4-5	
		Shrub Layer	Cover	14	0	0	0	0	0	14	0
			Heights							2-5	

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
	Hardwood trees	Canopy	Cover	55	0	55	0	0	0	0	0
			Heights			10-15					
		Subcanopy	Cover	70	0	0	70	0	0	0	0
			Heights				8-12				
	Evergreen shrubs	Shrub Layer	Cover	38	0	0	0	0	0	38	0
			Heights							2-5	
KM1-3	Hemlock trees	Subcanopy	Cover	87	0	0	70	0	32	0	0
			Heights				4-15		1.4-4		
		Low Midstory	Cover	13	0	0	0	0	13	0	0
			Heights						1.4-4		
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			10-20					
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	5	0	0	0	0	0	5	0
			Heights							1.4-1.7	
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Deciduous shrubs	Low Midstory	Cover	14	0	0	0	0	14	0	0
			Heights						1.4-4		
		Shrub Layer	Cover	6	0	0	0	0	0	6	0
			Heights							1.4-1.7	
KM1-4	Hemlock trees	Low Midstory	Cover	95	0	0	0	0	95	12	0
			Heights						3-10	2-3	
		Shrub Layer	Cover	42	0	0	0	0	0	35	9
			Heights							1.4-3	0-1.4
		Understory	Cover	25	0	0	0	0	0	0	25
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	90	0	90	0	0	0	0	0
			Heights			9-20					
		Subcanopy	Cover	31	0	0	31	0	0	0	0
			Heights				9-15				
	Pine trees	Shrub Layer	Cover	9	0	0	0	0	0	0	9
			Heights								0-1.4
KM2-1	Hemlock trees	Subcanopy	Cover	65	0	0	44	0	0	0	35
			Heights				5-15				0.5-1.4
		Understory	Cover	5	0	0	0	0	0	0	5
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	41	0	41	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	87	0	0	87	0	0	0	0
			Heights				8-15				
		Low Midstory	Cover	17	0	0	0	0	17	0	0
			Heights						4-5		

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
KM2-2	Hemlock trees	Subcanopy	Cover	100	0	0	100	0	0	0	0
			Heights				10-15				
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-20					
KM2-3	Hemlock trees	Subcanopy	Cover	74	0	0	74	0	0	0	0
			Heights				3-15				
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-20					
		Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4
	Evergreen shrubs	Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4
KM2-4	Hemlock trees	Subcanopy	Cover	40	0	0	37	0	0	0	7
			Heights				4-15				0.5-1.4
	Hardwood trees	Canopy	Cover	68	0	68	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	80	0	0	80	0	0	0	0
			Heights				8-15				
		Shrub Layer	Cover	27	0	0	0	0	0	27	0
			Heights							2-4	
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Deciduous shrubs	Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
KM3-1	Hemlock trees	Canopy	Cover	19	0	19	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	72	0	0	72	0	0	0	0
			Heights				5-15				
	Hardwood trees	Canopy	Cover	52	0	52	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	22	0	0	22	0	0	0	0
			Heights				12-15				
KM3-2	Hemlock trees	Subcanopy	Cover	100	0	0	100	0	0	18	0
			Heights				2.5-15			2-2.5	
		Shrub Layer	Cover	9	0	0	0	0	0	9	0
			Heights							1.4-2.5	
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			20-30					
KM3-3	Hemlock trees	Subcanopy	Cover	38	0	0	38	0	18	0	0
			Heights				10-15		4-10		
	Hardwood trees	Canopy	Cover	52	0	52	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	25	0	0	25	0	0	0	0
			Heights				12-15				

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Low Midstory	Cover	79	0	0	0	0	79	0	0
			Heights						4-10		
KM3-4	Hemlock trees	Subcanopy	Cover	72	0	0	68	0	0	5	0
			Heights				3-15			2.9-3	
		Shrub Layer	Cover	13	0	0	0	0	0	13	0
			Heights							2-3	
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-20					
MH1-1	Hemlock trees	Canopy	Cover	16	0	16	0	0	0	0	0
			Heights			15-25					
		Subcanopy	Cover	70	0	0	70	0	0	0	0
			Heights				4-12				
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	68	0	68	0	0	0	0	0
			Heights			20-25					
	Evergreen shrubs	Shrub Layer	Cover	12	0	0	0	0	0	12	0
			Heights							1.4-2	
		Understory	Cover	77	0	0	0	0	0	0	77
			Heights								0-1.4
MH1-2	Hemlock trees	Canopy	Cover	31	0	31	0	0	0	0	0
			Heights			20-30					
		High Midstory	Cover	100	0	0	0	100	0	0	0
			Heights					6-12			
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			25-30					
		High Midstory	Cover	12	0	0	0	12	0	0	0
			Heights					9-12			
	Evergreen shrubs	Shrub Layer	Cover	24	0	0	0	0	0	24	0
			Heights							1.4-3	
		Understory	Cover	69	0	0	0	0	0	0	69
			Heights								0-1.4
MH1-3	Hemlock trees	Canopy	Cover	14	0	14	0	0	0	0	0
			Heights			20-30					
		High Midstory	Cover	26	0	0	0	15	21	0	0
			Heights					5.5-12	2.5-5.5		
	Hardwood trees	Subcanopy	Cover	96	0	0	96	0	0	0	0
			Heights				20-25				
	Evergreen shrubs	Shrub Layer	Cover	32	0	0	0	0	0	32	0
			Heights							1.4-2	
		Understory	Cover	32	0	0	0	0	0	0	32
			Heights								0-1.4
	Deciduous shrubs	Low Midstory	Cover	35	0	0	0	0	34	1	0
			Heights						4-5.5	1.4-2	
MH1-4	Hemlock trees	Canopy	Cover	89	0	89	0	0	0	0	0
			Heights			20-30					

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Subcanopy	Cover	24	0	0	18	0	24	0	0
			Heights				7-12		5-7		
		Low Midstory	Cover	29	0	0	0	0	29	0	0
			Heights						5-7		
		Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4
	Hardwood trees	Subcanopy	Cover	52	0	0	52	0	0	0	0
			Heights				10-12				
	Evergreen shrubs	Shrub Layer	Cover	13	0	0	0	0	0	13	0
			Heights							1.4-2.5	
		Understory	Cover	42	0	0	0	0	0	0	42
			Heights								0-1.4
	Deciduous shrubs	Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
MH2-1	Hardwood trees	Subcanopy	Cover	40	0	0	40	0	0	0	0
			Heights				15-18				
		Shrub Layer	Cover	7	0	0	0	0	0	7	0
			Heights							1.4-2.5	
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	40	0	0	0	0	0	40	0
			Heights							1.4-2.5	
		Understory	Cover	54	0	0	0	0	0	0	54
			Heights								0-1.4
	Deciduous shrubs	Low Midstory	Cover	40	0	0	0	0	40	0	0
			Heights						2.5-4		
		Shrub Layer	Cover	4	0	0	0	0	0	4	0
			Heights							1.4-2.5	
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
MH2-2	Hemlock trees	Canopy	Cover	62	0	62	0	0	0	0	0
			Heights			20-25					
		Low Midstory	Cover	28	0	0	0	0	28	0	0
			Heights						2-10		
		Uprooted	Cover	5	0	0	0	0	0	5	0
			Heights							1.4-2	
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	15	0	15	0	0	0	0	0
			Heights			20-25					
		Subcanopy	Cover	38	0	0	38	0	0	0	0
			Heights				15-18				
		Understory	Cover	6	0	0	0	0	0	0	6
			Heights								0-1.4
	Deciduous shrubs	Shrub Layer	Cover	4	0	0	0	0	0	4	0
			Heights							1.4-2	

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Understory	Cover	5	0	0	0	0	0	0	5
			Heights								0-1.4
MH2-3	Hemlock trees	Canopy	Cover	46	0	46	0	0	0	0	0
			Heights			20-25					
		Low Midstory	Cover	38	0	0	0	0	38	10	0
			Heights						2-6	1.4-2	
	Hardwood trees	Canopy	Cover	75	0	75	0	0	0	0	0
			Heights			15-25					
		Shrub Layer	Cover	4	0	0	0	0	0	4	0
			Heights							1.4-2	
	Evergreen shrubs	Shrub Layer	Cover	6	0	0	0	0	0	6	0
			Heights							1.4-2	
		Understory	Cover	60	0	0	0	0	0	0	60
			Heights								0-1.4
MH2-4	Hemlock trees	Canopy	Cover	100	0	100	45	0	0	0	0
			Heights			18-30	5-18				
	Hardwood trees	Subcanopy	Cover	49	0	0	49	28	0	0	0
			Heights				15-18	4-15			
		Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	10	0	0	0	0	0	10	0
			Heights							1.4-3	
		Understory	Cover	36	0	0	0	0	0	0	36
			Heights								0-1.4
MH3-1	Hemlock trees	Canopy	Cover	58	0	58	0	0	0	0	0
			Heights			8-20					
		Low Midstory	Cover	68	0	0	0	0	58	32	13
			Heights						4.5-12	3-4.5	0-1.4
		Shrub Layer	Cover	4	0	0	0	0	0	4	0
			Heights							1.4-4.5	
	Hardwood trees	Subcanopy	Cover	82	0	0	82	0	0	0	0
			Heights				12-18				
		Low Midstory	Cover	9	0	0	0	0	9	0	0
			Heights						4.5-12		
	Evergreen shrubs	Shrub Layer	Cover	41	0	0	0	0	0	41	0
			Heights							1.4-4.5	
		Understory	Cover	35	0	0	0	0	0	0	35
			Heights								0-1.4
	Deciduous shrubs	Shrub Layer	Cover	11	0	0	0	0	0	11	0
			Heights							1.4-4.5	
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
MH3-2	Hemlock trees	Canopy	Cover	97	0	97	0	0	0	0	0
			Heights			10-20					
		Shrub Layer	Cover	23	0	0	0	0	0	22	2
			Heights							1.4-4.5	0-1.4

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Understory	Cover	4	0	0	0	0	0	0	4
			Heights								0-1.4
	Hardwood trees	Subcanopy	Cover	17	0	0	17	0	0	0	0
			Heights				12-18				
	Evergreen shrubs	Shrub Layer	Cover	64	0	0	0	0	0	64	0
			Heights							1.4-4.5	
		Understory	Cover	49	0	0	0	0	0	0	49
			Heights								0-1.4
	Deciduous shrubs	Low Midstory	Cover	10	0	0	0	0	10	0	0
			Heights						3-4.5		
MH3-3	Hemlock trees	Canopy	Cover	88	0	88	0	0	0	0	0
			Heights			10-20					
		Shrub Layer	Cover	17	0	0	0	0	0	14	3
			Heights							1.4-1.8	0-1.4
		Understory	Cover	5	0	0	0	0	0	0	5
			Heights								0-1.4
	Hardwood trees	Subcanopy	Cover	81	0	0	81	0	0	0	0
			Heights				8-15				
	Evergreen shrubs	Shrub Layer	Cover	61	0	0	0	0	0	61	0
			Heights							1.4-5	
		Understory	Cover	34	0	0	0	0	0	0	34
			Heights								0-1.4
	Deciduous shrubs	Shrub Layer	Cover	29	0	0	0	0	0	29	0
			Heights							1.4-5	
MH3-4	Hemlock trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			10-25					
		Low Midstory	Cover	64	0	0	0	0	57	12	0
			Heights						3-6.5	2-3	
		Shrub Layer	Cover	10	0	0	0	0	0	10	0
			Heights							1.4-3	
	Hardwood trees	Subcanopy	Cover	59	0	0	59	0	0	0	0
			Heights				12-18				
	Evergreen shrubs	Shrub Layer	Cover	9	0	0	0	0	0	9	0
			Heights							1.4-3	
		Understory	Cover	43	0	0	0	0	0	0	43
			Heights								0-1.4
MM1-1	Hemlock trees	Subcanopy	Cover	93	0	0	93	0	0	0	0
			Heights				8-15				
	Hardwood trees	Canopy	Cover	75	0	75	0	0	0	0	0
			Heights			15-18					
		Subcanopy	Cover	56	0	0	56	0	0	0	0
			Heights				12-15				
		Shrub Layer	Cover	9	0	0	0	0	0	9	0
			Heights							2-4	
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
	Evergreen shrubs	Understory	Cover	20	0	0	0	0	0	0	20
			Heights								0-1.4
MM1-2	Hemlock trees	Subcanopy	Cover	100	0	0	100	0	0	0	0
			Heights				3-10				
		Uprooted	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	77	0	77	0	0	0	0	0
			Heights			12-18					
	Evergreen shrubs	Understory	Cover	21	0	0	0	0	0	0	21
			Heights								0-1.4
MM1-3	Hemlock trees	Subcanopy	Cover	41	0	0	41	0	16	0	0
			Heights				10-15		4-6		
		Low Midstory	Cover	28	0	0	0	0	28	0	0
			Heights						2.5-10		
		Understory	Cover	20	0	0	0	0	0	0	20
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	79	0	79	0	0	0	0	0
			Heights			13-18					
		Subcanopy	Cover	20	0	0	20	0	0	0	0
			Heights				12-15				
		Understory	Cover	8	0	0	0	0	0	0	8
			Heights								0-1.4
	Evergreen shrubs	Understory	Cover	8	0	0	0	0	0	0	8
			Heights								0-1.4
MM1-4	Hemlock trees	Low Midstory	Cover	68	0	0	0	0	68	0	0
			Heights						2.5-8		
	Hardwood trees	Canopy	Cover	74	0	74	0	0	0	0	0
			Heights			15-18					
		Subcanopy	Cover	50	0	0	50	0	0	0	0
			Heights				10-15				
	Evergreen shrubs	Shrub Layer	Cover	8	0	0	0	0	0	8	0
			Heights							1.4-2.5	
		Understory	Cover	32	0	0	0	0	0	0	32
			Heights								0-1.4
MM2-1	Hemlock trees	Subcanopy	Cover	41	0	0	41	0	0	0	0
			Heights				3-15				
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	51	0	0	51	24	0	0	0
			Heights				12-15	3-12			
		Shrub Layer	Cover	13	0	0	0	0	0	13	0
			Heights							1.4-1.6	
		Understory	Cover	9	0	0	0	0	0	0	9
			Heights								0-1.4
	Deciduous shrubs	Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
MM2-2	Hemlock trees	Canopy	Cover	55	0	55	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	41	0	0	41	0	0	0	0
			Heights				8-15				
	Hardwood trees	Canopy	Cover	54	0	54	0	0	0	0	0
			Heights			15-20					
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Deciduous shrubs	Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
MM2-3	Hemlock trees	Subcanopy	Cover	100	0	0	100	0	0	0	0
			Heights				10-15				
		Shrub Layer	Cover	4	0	0	0	0	0	4	0
			Heights							2-2.5	
		Uprooted	Cover	18	0	0	0	0	0	13	5
			Heights							2-2.5	0-1.4
		Understory	Cover	4	0	0	0	0	0	0	4
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	50	0	50	0	0	0	0	0
			Heights			15-18					
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
MM2-4	Hemlock trees	Canopy	Cover	68	0	68	0	0	0	0	0
			Heights			15-20					
		Subcanopy	Cover	42	0	0	42	0	0	0	0
			Heights				8-15				
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-20					
MM3-1	Hemlock trees	Canopy	Cover	86	0	86	0	0	21	0	0
			Heights			8-25			5-8		
		Low Midstory	Cover	38	0	0	0	0	38	7	0
			Heights						3-8	2.5-3	
	Hardwood trees	Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	15	0	0	0	0	0	15	0
			Heights							1.4-3	
		Understory	Cover	13	0	0	0	0	0	0	13
			Heights								0-1.4
	Deciduous shrubs	Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
MM3-2	Hemlock trees	Canopy	Cover	60	0	60	0	0	0	0	0
			Heights			15-25					
		Subcanopy	Cover	36	0	0	36	0	0	0	0
			Heights				5-10				
	Hardwood trees	Subcanopy	Cover	51	0	0	51	0	0	0	0
			Heights				20-23				

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
	Evergreen shrubs	Understory	Cover	5	0	0	0	0	0	0	5
			Heights								0-1.4
	Deciduous shrubs	Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
MM3-3	Hemlock trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			4-25					
MM3-4	Hemlock trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-25					
		Subcanopy	Cover	25	0	0	25	0	0	0	0
			Heights				10-20				
	Hardwood trees	Shrub Layer	Cover	12	0	0	0	0	0	12	0
			Heights							2-4	
MX1-1	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			10-12					
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	12	0	0	0	0	0	12	0
			Heights							2-3	
		Understory	Cover	30	0	0	0	0	0	0	30
			Heights								0-1.4
	Deciduous shrubs	Low Midstory	Cover	47	0	0	0	0	47	0	0
			Heights						4-5		
MX1-2	Hemlock trees	Subcanopy	Cover	83	0	0	71	0	83	40	4
			Heights				6-10		3.5-6	1.4-3.5	0-1.4
	Hardwood trees	Canopy	Cover	78	0	78	0	0	0	0	0
			Heights			12-15					
		Subcanopy	Cover	21	0	0	21	0	0	0	0
			Heights				8-10				
		Low Midstory	Cover	30	0	0	0	0	30	0	0
			Heights						4-6		
		Shrub Layer	Cover	11	0	0	0	0	0	11	0
			Heights							2-3.5	
		Understory	Cover	16	0	0	0	0	0	0	16
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	5	0	0	0	0	0	5	0
			Heights							1.4-2.5	
		Understory	Cover	20	0	0	0	0	0	0	20
			Heights								0-1.4
MX1-3	Hemlock trees	Canopy	Cover	19	0	19	0	0	0	0	0
			Heights			8-10					
		Low Midstory	Cover	35	0	0	0	0	35	18	0
			Heights						3-8	2-3	
	Hardwood trees	Canopy	Cover	75	0	75	0	0	0	0	0
			Heights			10-20					
		Subcanopy	Cover	21	0	0	21	0	0	0	0
			Heights				10-15				

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Low Midstory	Cover	31	0	0	0	0	31	0	0
			Heights						8-10		
		Understory	Cover	9	0	0	0	0	0	0	9
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	4	0	0	0	0	0	4	0
			Heights							2-3	
		Understory	Cover	36	0	0	0	0	0	0	36
			Heights								0-1.4
MX1-4	Hemlock trees	Subcanopy	Cover	33	0	0	33	0	0	0	0
			Heights				3-7				
	Hardwood trees	Subcanopy	Cover	100	0	0	75	0	77	0	0
			Heights				12-18		5-10		
		Shrub Layer	Cover	17	0	0	0	0	0	17	0
			Heights							1.4-3	
		Understory	Cover	9	0	0	0	0	0	0	9
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	21	0	0	0	0	0	21	0
			Heights							1.4-3	
		Understory	Cover	13	0	0	0	0	0	0	13
			Heights								0-1.4
MX2-1	Hemlock trees	Low Midstory	Cover	35	0	0	0	0	35	0	0
			Heights						8-10		
	Hardwood trees	Canopy	Cover	34	0	34	0	0	0	0	0
			Heights			12-15					
		Subcanopy	Cover	69	0	0	69	0	0	0	0
			Heights				8-14				
		Low Midstory	Cover	31	0	0	0	0	31	0	0
			Heights						5-6		
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Understory	Cover	25	0	0	0	0	0	0	25
			Heights								0-1.4
MX2-2	Hemlock trees	Subcanopy	Cover	21	0	0	12	0	14	0	7
			Heights				7-12		4-5		1-1.4
	Hardwood trees	Canopy	Cover	95	0	95	0	0	0	0	0
			Heights			10-15					
		Low Midstory	Cover	58	0	0	0	0	58	0	0
			Heights						5-10		
	Evergreen shrubs	Low Midstory	Cover	5	0	0	0	0	5	0	0
			Heights						4-10		
		Understory	Cover	37	0	0	0	0	0	0	37
			Heights								0-1.4
MX2-3	Hemlock trees	Subcanopy	Cover	27	0	0	27	0	21	2	0
			Heights				8-13		6-8	2-2.5	
		Shrub Layer	Cover	7	0	0	0	0	0	7	0
			Heights							1.4-2.5	

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
	Hardwood trees	Canopy	Cover	83	0	83	0	0	0	0	0
			Heights			10-15					
		Subcanopy	Cover	70	0	0	70	0	0	0	0
			Heights				8-12				
		Low Midstory	Cover	3	0	0	0	0	3	0	0
			Heights						7-8		
		Shrub Layer	Cover	4	0	0	0	0	0	4	0
			Heights							1.4-2.5	
	Evergreen shrubs	Low Midstory	Cover	9	0	0	0	0	9	0	0
			Heights						5-8		
		Shrub Layer	Cover	45	0	0	0	0	0	45	0
			Heights							1.4-2.5	
		Understory	Cover	43	0	0	0	0	0	0	43
			Heights								0-1.4
MX2-4	Hemlock trees	Low Midstory	Cover	47	0	0	0	0	32	16	0
			Heights						2.5-5	2-2.5	
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			10-15					
		Subcanopy	Cover	60	0	0	60	0	0	0	0
			Heights				5-8				
	Evergreen shrubs	Shrub Layer	Cover	13	0	0	0	0	0	13	0
			Heights							1.4-2.5	
		Understory	Cover	28	0	0	0	0	0	0	28
			Heights								0-1.4
MX3-1	Hemlock trees	Subcanopy	Cover	98	0	0	98	0	0	7	5
			Heights				2.5-10			1.4-2.5	0-1.4
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			10-17					
		Subcanopy	Cover	35	0	0	35	0	0	0	0
			Heights				4-10				
	Evergreen shrubs	Shrub Layer	Cover	4	0	0	0	0	0	4	0
			Heights							1.4-2.5	
		Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4
MX3-2	Hardwood trees	Canopy	Cover	60	0	60	0	0	0	0	0
			Heights			10-18					
		Subcanopy	Cover	46	0	0	46	0	0	0	0
			Heights				5-10				
		Low Midstory	Cover	14	0	0	0	0	14	0	0
			Heights						3.5-4.5		
		Shrub Layer	Cover	6	0	0	0	0	0	6	0
			Heights							1.4-3.5	
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	13	0	0	0	0	0	13	0
			Heights							1.4-3.5	

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Understory	Cover	22	0	0	0	0	0	0	22
			Heights								0-1.4
MX3-3	Hemlock trees	Subcanopy	Cover	92	0	0	88	0	0	19	12
			Heights				2.5-10			1.4-2.5	0-1.4
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			10-17					
		Subcanopy	Cover	24	0	0	24	0	0	0	0
			Heights				7-10				
	Evergreen shrubs	Shrub Layer	Cover	3	0	0	0	0	0	3	0
			Heights							1.4-2.5	
		Understory	Cover	12	0	0	0	0	0	0	12
			Heights								0-1.4
MX3-4	Hardwood trees	Canopy	Cover	70	0	70	0	0	0	0	0
			Heights			10-20					
		Subcanopy	Cover	100	0	0	100	0	27	0	0
			Heights				5-12		2.5-5		
	Evergreen shrubs	Low Midstory	Cover	36	0	0	0	0	36	0	0
			Heights						3.5-6		
		Shrub Layer	Cover	27	0	0	0	0	0	27	0
			Heights							1.4-4	
		Understory	Cover	29	0	0	0	0	0	0	29
			Heights								0-1.4
WH1-1	Hemlock trees	Canopy	Cover	82	0	82	0	0	0	0	0
			Heights			18-25					
		High Midstory	Cover	30	0	0	0	30	0	0	0
			Heights					5-12			
		Understory	Cover	7	0	0	0	0	0	0	7
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	81	0	81	0	0	0	0	0
			Heights			20-25					
	Evergreen shrubs	Shrub Layer	Cover	16	0	0	0	0	0	16	0
			Heights							1.4-4	
		Understory	Cover	66	0	0	0	0	0	0	66
			Heights								0-1.4
WH1-2	Hemlock trees	Subcanopy	Cover	100	0	0	100	0	0	0	0
			Heights				12-20				
		Low Midstory	Cover	9	0	0	0	0	9	0	0
			Heights						5.5-6		
	Hardwood trees	Canopy	Cover	54	0	54	0	0	0	0	0
			Heights			20-25					
	Evergreen shrubs	Shrub Layer	Cover	49	0	0	0	0	0	49	0
			Heights							1.4-3.5	
		Understory	Cover	49	0	0	0	0	0	0	49
			Heights								0-1.4
WH1-3	Hemlock trees	Subcanopy	Cover	86	0	0	86	0	0	0	0
			Heights				12-20				

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		High Midstory	Cover	16	0	0	0	16	0	0	0
			Heights					8-12			
	Hardwood trees	Canopy	Cover	78	0	78	0	0	0	0	0
			Heights			18-25					
	Evergreen shrubs	Shrub Layer	Cover	35	0	0	0	0	0	35	0
			Heights							1.4-4	
		Understory	Cover	63	0	0	0	0	0	0	63
			Heights								0-1.4
WH1-4	Hemlock trees	Subcanopy	Cover	51	0	0	51	0	0	0	0
			Heights				10-20				
		High Midstory	Cover	24	0	0	0	24	0	0	0
			Heights					6-12			
	Hardwood trees	Subcanopy	Cover	30	0	0	27	0	0	0	0
			Heights				13-20				
	Evergreen shrubs	Shrub Layer	Cover	2	0	0	0	0	0	2	0
			Heights							1.4-3	
		Understory	Cover	31	0	0	0	0	0	0	31
			Heights								0-1.4
WH2-1	Hemlock trees	Subcanopy	Cover	24	0	0	24	0	0	0	0
			Heights				12-16				
		High Midstory	Cover	17	0	0	0	17	12	0	0
			Heights					4.5-10	3-4.5		
	Hardwood trees	Canopy	Cover	92	0	92	0	0	0	0	0
			Heights			15-20					
		Low Midstory	Cover	21	0	0	0	0	21	0	0
			Heights						3-4.5		
	Evergreen shrubs	Shrub Layer	Cover	31	0	0	0	0	0	31	0
			Heights							1.4-3	
		Understory	Cover	67	0	0	0	0	0	0	67
			Heights								0-1.4
WH2-2	Hemlock trees	Canopy	Cover	16	0	16	0	0	0	0	0
			Heights			15-25					
		High Midstory	Cover	25	0	0	0	20	0	20	0
			Heights					4.5-10		2-2.5	
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			20-25					
		Subcanopy	Cover	46	0	0	46	0	0	0	0
			Heights				10-20				
	Evergreen shrubs	Shrub Layer	Cover	27	0	0	0	0	0	27	0
			Heights							1.4-2.5	
		Understory	Cover	58	0	0	0	0	0	0	58
			Heights								0-1.4
WH2-3	Hemlock trees	Canopy	Cover	91	0	91	0	0	0	0	0
			Heights			15-25					
		High Midstory	Cover	30	0	0	0	30	0	0	0
			Heights					3-10			

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
	Hardwood trees	Canopy	Cover	5	0	5	0	0	0	0	0
			Heights			20-25					
	Evergreen shrubs	Shrub Layer	Cover	17	0	0	0	0	0	17	0
			Heights							1.4-3	
		Understory	Cover	29	0	0	0	0	0	0	29
			Heights								0-1.4
WH2-4	Hemlock trees	Canopy	Cover	68	0	68	0	0	0	0	0
			Heights			9-20					
		Subcanopy	Cover	16	0	0	11	0	16	14	0
			Heights				5-10		3-5	2.5-3	
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-20					
		Low Midstory	Cover	5	0	0	0	0	5	0	0
			Heights						4-5		
	Evergreen shrubs	Shrub Layer	Cover	31	0	0	0	0	0	31	0
			Heights							1.4-3	
		Understory	Cover	74	0	0	0	0	0	0	74
			Heights								0-1.4
WH3-1	Hemlock trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			8-18					
		Subcanopy	Cover	35	0	0	35	0	0	0	0
			Heights				3.5-10				
	Evergreen shrubs	Shrub Layer	Cover	48	0	0	0	0	0	48	0
			Heights							1.4-3.5	
		Understory	Cover	53	0	0	0	0	0	0	53
			Heights								0-1.4
WH3-2	Hemlock trees	Canopy	Cover	47	0	47	0	0	0	0	0
			Heights			10-18					
		Subcanopy	Cover	80	0	0	80	0	0	0	0
			Heights				5-15				
	Hardwood trees	Subcanopy	Cover	51	0	0	51	0	0	0	0
			Heights				8-15				
	Evergreen shrubs	Shrub Layer	Cover	64	0	0	0	0	0	64	0
			Heights							1.4-3.5	
		Understory	Cover	43	0	0	0	0	0	0	43
			Heights								0-1.4
WH3-3	Hemlock trees	Canopy	Cover	88	0	88	0	0	0	0	0
			Heights			8-20					
		Subcanopy	Cover	54	0	0	54	0	0	0	0
			Heights				8-10				
	Hardwood trees	Canopy	Cover	28	0	28	0	0	0	0	0
			Heights			17-20					
		Low Midstory	Cover	9	0	0	0	0	9	0	0
			Heights						5-8		
	Evergreen shrubs	Shrub Layer	Cover	41	0	0	0	0	0	41	0
			Heights							1.4-3	

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Understory	Cover	31	0	0	0	0	0	0	31
			Heights								0-1.4
WH3-4	Hemlock trees	Canopy	Cover	51	0	51	0	0	0	0	0
			Heights			10-18					
		Subcanopy	Cover	47	0	0	47	0	0	0	0
			Heights				6-12				
	Hardwood trees	Subcanopy	Cover	36	0	0	36	0	0	0	0
			Heights				10-12				
		Low Midstory	Cover	22	0	0	0	0	22	0	0
			Heights						3.2-3.5		
		Understory	Cover	2	0	0	0	0	0	0	2
			Heights								0-1.4
	Evergreen shrubs	Shrub Layer	Cover	23	0	0	0	0	0	23	0
			Heights							1.4-2.5	
		Understory	Cover	57	0	0	0	0	0	0	57
			Heights								0-1.4
WX1-1	Hemlock trees	Subcanopy	Cover	69	0	0	61	0	0	8	0
			Heights				10-15			3.4-3.5	
		Shrub Layer	Cover	23	0	0	0	0	0	23	0
			Heights							2.5-3.5	
	Hardwood trees	Canopy	Cover	72	0	72	0	0	0	0	0
			Heights			15-20					
		Low Midstory	Cover	15	0	0	0	0	15	0	0
			Heights						10-12		
		Understory	Cover	5	0	0	0	0	0	0	5
			Heights								0-1.4
WX1-2	Hemlock trees	Canopy	Cover	100	0	100	0	0	19	0	0
			Heights			5-25			2-5		
		Low Midstory	Cover	23	0	0	0	0	23	0	8
			Heights						1.4-5		0.5-1.4
	Hardwood trees	Subcanopy	Cover	22	0	0	22	0	0	0	0
			Heights				15-20				
WX1-3	Hemlock trees	Subcanopy	Cover	36	0	0	36	0	17	0	10
			Heights				5-18		3-5		0-1.4
		Shrub Layer	Cover	50	0	0	0	0	0	47	33
			Heights							1.4-3	0.5-1.4
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			18-23					
		Subcanopy	Cover	14	0	0	14	0	0	0	0
			Heights				8-18				
		Low Midstory	Cover	78	0	0	0	0	78	0	0
			Heights						3-5		
		Understory	Cover	6	0	0	0	0	0	0	6
			Heights								0-1.4
WX1-4	Hemlock trees	Subcanopy	Cover	8	0	0	0	0	8	0	0
			Heights						4-4.2		

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Low Midstory	Cover	70	0	0	0	0	54	0	41
			Heights						1.4-6		0.5-1.4
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-25					
		Subcanopy	Cover	47	0	0	39	0	20	0	0
			Heights				6-10		4-4.2		
		Low Midstory	Cover	26	0	0	0	0	26	0	0
			Heights						2-4.5		
		Understory	Cover	14	0	0	0	0	0	0	14
			Heights								0-1.4
	Deciduous shrubs	Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
WX2-1	Hemlock trees	Canopy	Cover	87	0	87	0	0	0	0	12
			Heights			3-20					0-1.4
	Hardwood trees	Canopy	Cover	52	0	52	0	0	0	0	0
			Heights			13-20					
		Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4
WX2-2	Hemlock trees	Canopy	Cover	70	0	70	0	0	0	22	0
			Heights			10-20				2.5-3.5	
		Shrub Layer	Cover	19	0	0	0	0	0	19	12
			Heights							1.4-3.5	0-1.4
	Hardwood trees	Canopy	Cover	87	0	87	0	0	0	0	0
			Heights			17-20					
		Shrub Layer	Cover	9	0	0	0	0	0	9	0
			Heights							2-2.5	
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
	Evergreen shrubs	Understory	Cover	5	0	0	0	0	0	0	5
			Heights								0-1.4
	Deciduous shrubs	Understory	Cover	5	0	0	0	0	0	0	5
			Heights								0-1.4
WX2-3	Hemlock trees	Subcanopy	Cover	57	0	0	57	0	0	14	6
			Heights				6-20			1.4-2.5	0.5-1.4
		Shrub Layer	Cover	20	0	0	0	0	0	17	4
			Heights							1.4-3.5	0-1.4
	Hardwood trees	Canopy	Cover	54	0	54	0	0	0	0	0
			Heights			12-23					
		Low Midstory	Cover	25	0	0	0	0	25	0	0
			Heights						3.5-6		
		Shrub Layer	Cover	7	0	0	0	0	0	7	0
			Heights							1.4-3.5	
		Understory	Cover	9	0	0	0	0	0	0	9
			Heights								0-1.4
	Deciduous shrubs	Understory	Cover	4	0	0	0	0	0	0	4
			Heights								0-1.4

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
WX2-4	Hemlock trees	Canopy	Cover	52	0	35	0	0	17	0	0
			Heights			10-20			5-10		
		Low Midstory	Cover	49	0	0	0	0	49	25	0
			Heights						3-10	2-3	
		Shrub Layer	Cover	7	0	0	0	0	0	1	6
			Heights							1.4-3	1-1.4
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			15-20					
		Shrub Layer	Cover	8	0	0	0	0	0	8	0
			Heights							1.4-2	
		Understory	Cover	16	0	0	0	0	0	0	16
			Heights								0-1.4
	Deciduous shrubs	Shrub Layer	Cover	4	0	0	0	0	0	4	0
			Heights							1.4-2	
WX3-1	Hemlock trees	Subcanopy	Cover	62	0	0	62	0	0	11	0
			Heights				5-17			1.4-3	
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			17-20					
		Subcanopy	Cover	26	0	0	26	0	0	0	0
			Heights				12-18				
		Understory	Cover	1	0	0	0	0	0	0	1
			Heights								0-1.4
WX3-2	Hemlock trees	Canopy	Cover	36	0	36	0	0	0	0	0
			Heights			10-20					
		Subcanopy	Cover	67	0	0	67	0	0	13	0
			Heights				2.5-17			2-2.5	
	Hardwood trees	Canopy	Cover	87	0	87	0	0	0	0	0
			Heights			16-20					
	Evergreen shrubs	Shrub Layer	Cover	30	0	0	0	0	0	30	0
			Heights							1.4-2.5	
		Understory	Cover	14	0	0	0	0	0	0	14
			Heights								0-1.4
WX3-3	Hemlock trees	Subcanopy	Cover	70	0	0	67	0	3	0	0
			Heights				8-18		2-3.5		
		Low Midstory	Cover	14	0	0	0	0	14	0	0
			Heights						2-3.5		
		Shrub Layer	Cover	3	0	0	0	0	0	3	0
			Heights							1.4-2	
	Hardwood trees	Canopy	Cover	50	0	50	0	0	0	0	0
			Heights			15-22					
WX3-4	Hemlock trees	Subcanopy	Cover	31	0	0	31	0	0	0	0
			Heights				13-18				
		Low Midstory	Cover	38	0	0	0	0	38	0	5
			Heights						3.5-14		0.3-1.4
		Shrub Layer	Cover	44	0	0	0	0	0	42	12
			Heights							1.4-3.5	0.3-1.4

Plot - Transect	Species / Group	Assigned Stratum		Total Cover	Vertical Stratification of Cover and Height values						
					Super-canopy	Canopy	Sub-canopy	High Midstory	Low Midstory	Shrub Layer	Under-story
		Understory	Cover	3	0	0	0	0	0	0	3
			Heights								0-1.4
	Hardwood trees	Canopy	Cover	100	0	100	0	0	0	0	0
			Heights			17-22					

Appendix F. Mean frequency of occurrence (%) of all plants (including trees< 8cm dbh and < 1.4m tall, and shrubs < 1.4m tall) in twenty 0.25m^2 quadrats evenly spaced along each of the four transects in each 400 m^2 hemlock ecosystem monitoring plot sampled in July, 1999. Each plot is identified by a three-character code. The first character of the code represents the geographic location of the plot: F= Fayetteville, W= Wolf Creek, K= Kates Branch, G= Grandview, M= Meadow River, and C= Carnifex Ferry State Park. The second character equates with the principle study design, which consists of 3 levels along a moisture gradient; H= Hydric, M= Mesic, and X= Xeric. The third character is the replication number.

Growth Form	Species or Group	CH1	CH2	CH3	CM1	CM2	CM3	CX1	CX2	CX3
Trees	Acer negundo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Acer pensylvanicum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Acer rubrum/spicatum	1.3	3.8	0.0	36.3	26.3	12.5	60.0	3.8	6.3
	Acer saccharum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Betula alleghaniensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Betula lenta	6.3	1.3	0.0	0.0	1.3	0.0	1.3	1.3	0.0
	Carya glabra	0.0	0.0	0.0	0.0	0.0	1.3	3.8	0.0	0.0
	Carya tomentosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
	Fagus grandifolia	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Fraxinus americana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Liriodendron tulipifera	8.8	1.3	1.3	5.0	0.0	1.3	8.8	0.0	2.5
	Magnolia acuminata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Magnolia fraseri	0.0	0.0	1.3	0.0	0.0	2.5	0.0	0.0	0.0
	Magnolia tripetala	0.0	1.3	0.0	0.0	0.0	1.3	0.0	0.0	0.0
	Nyssa sylvatica	3.8	1.3	1.3	1.3	0.0	1.3	2.5	1.3	0.0
	Oxydendrum arboreum	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Prunus serotina	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Quercus alba	0.0	1.3	0.0	1.3	2.5	2.5	10.0	0.0	1.3
	Quercus prinus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Quercus rubra	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Quercus velutina	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sassafras albidum	1.3	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0
	Tsuga canadensis	2.5	6.3	3.8	0.0	0.0	2.5	6.3	0.0	0.0
Shrubs	Aralia spinosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Clethra acuminata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Euonymus americanus	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0
	Gaultheria procumbens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Hamamelis virginiana	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
	Hydrangea arborescens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ilex montana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5
	Ilex opaca	1.3	1.3	1.3	5.0	1.3	8.8	2.5	0.0	0.0
	Kalmia latifolia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ostrya virginiana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Prunus pensylvanica	0.0	0.0	0.0	0.0	0.0	0.0	2.5	1.3	0.0
	Rhododendron maximum	20.0	35.0	45.0	0.0	0.0	27.5	0.0	0.0	0.0
	Rhododendron sp.	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0
	Rubus hispidus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Rubus spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vaccinium pallidum	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0
	Vibirnum acerifolium	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
	Viburnum nudum var. cassinoides	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix F Continued.

Growth Form	Species or Group	CH1	CH2	CH3	CM1	CM2	CM3	CX1	CX2	CX3
Vines	Dioscorea quaternata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Parthenocissus quinquefolia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Smilax ecirrata	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
	Smilax glauca	0.0	0.0	0.0	15.0	16.3	2.5	35.0	6.3	3.8
	Smilax rotundifolia	1.3	1.3	1.3	53.8	11.3	2.5	38.8	5.0	5.0
	Toxicodendron radicans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vitis aestivalis	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
Bryophytes	mosses	63.8	66.3	76.3	30.0	11.3	27.5	43.8	28.8	15.0
Ferns	Dryopteris carthusiana	6.3	0.0	0.0	7.5	0.0	0.0	0.0	0.0	1.3
	Dryopteris marginalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Lycopodium digitatum	0.0	0.0	0.0	0.0	0.0	0.0	11.3	0.0	0.0
	Polystichum acrostichoides	1.3	0.0	0.0	10.0	0.0	0.0	0.0	8.8	0.0
	Thelypteris noveboracensis	0.0	0.0	0.0	51.3	0.0	0.0	10.0	0.0	0.0
Broadleaf Herbs	Amphicarpaea bracteata	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
	Anemone lancifolia	0.0	0.0	0.0	30.0	0.0	0.0	5.0	0.0	0.0
	Arisaema triphyllum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Aster spp.	0.0	0.0	0.0	3.8	0.0	0.0	2.5	0.0	0.0
	Boehmeria cylindrica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chimaphila maculata	0.0	0.0	1.3	0.0	0.0	0.0	1.3	0.0	2.5
	Conopholis americana	0.0	0.0	0.0	0.0	0.0	0.0	3.8	3.8	0.0
	Cypripedium spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Disporum spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
	Eupatorium rugosum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Galium circaezans	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0
	Galium triflorum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Goodyera pubescens	0.0	5.0	0.0	5.0	0.0	1.3	5.0	0.0	0.0
	Hexastylis virginica	15.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0
	Lycopus americanus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Medeola virginiana	0.0	0.0	0.0	5.0	0.0	0.0	1.3	0.0	0.0
	Mitchella repens	7.5	0.0	1.3	8.8	5.0	8.8	22.5	0.0	0.0
	Osmorhiza longistylis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Oxalis acetosella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Panax quinquefolius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Prenanthes sp.	0.0	0.0	0.0	7.5	0.0	0.0	2.5	0.0	0.0
	Scutellaria elliptica	0.0	0.0	0.0	3.8	0.0	0.0	1.3	0.0	0.0
	Senecio aureus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Smilacina racemosa	0.0	0.0	0.0	2.5	0.0	0.0	1.3	0.0	3.8
	Uvularia perfoliata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Viola blanda	0.0	0.0	0.0	56.3	0.0	0.0	10.0	0.0	0.0
	Viola cucullata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Viola hastata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grasses/Sedges	Cinna arundinacea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Carex digitalis	0.0	0.0	0.0	8.8	0.0	0.0	7.5	0.0	0.0
	Carex intumescens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Carex laxiflora	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	0.0
	Cymophyllus fraseri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Danthonia compressa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Luzula multiflora	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
	Panicum boscii	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
	Panicum dichotomum	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0

Appendix F Continued.

Growth Form	Species or Group	MH1	MH2	MH3	MM1	MM2	MM3	MX1	MX2	MX3
Trees	Acer negundo	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Acer pensylvanicum	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
	Acer rubrum/spicatum	0.0	0.0	0.0	1.3	6.3	11.3	1.3	2.5	2.5
	Acer saccharum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Betula alleghaniensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Betula lenta	1.3	17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Carya glabra	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Carya tomentosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Fagus grandifolia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Fraxinus americana	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
	Liriodendron tulipifera	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
	Magnolia acuminata	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0
	Magnolia fraseri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
	Magnolia tripetala	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Nyssa sylvatica	0.0	0.0	0.0	6.3	0.0	1.3	0.0	0.0	1.3
	Oxydendrum arboreum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
	Prunus serotina	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Quercus alba	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Quercus prinus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Quercus rubra	0.0	0.0	0.0	0.0	0.0	0.0	2.5	1.3	0.0
	Quercus velutina	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
	Sassafras albidum	7.5	0.0	0.0	0.0	0.0	11.3	6.3	0.0	1.3
	Tsuga canadensis	2.5	1.3	5.0	0.0	0.0	1.3	1.3	0.0	0.0
Shrubs	Aralia spinosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Clethra acuminata	1.3	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0
	Euonymus americanus	0.0	0.0	0.0	2.5	18.8	0.0	0.0	2.5	0.0
	Gaultheria procumbens	0.0	0.0	0.0	0.0	0.0	0.0	37.5	0.0	3.8
	Hamamelis virginiana	0.0	2.5	0.0	0.0	0.0	0.0	2.5	1.3	0.0
	Hydrangea arborescens	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	0.0
	Ilex montana	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Ilex opaca	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	2.5
	Kalmia latifolia	0.0	0.0	0.0	0.0	0.0	0.0	17.5	0.0	6.3
	Ostrya virginiana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Prunus pensylvanica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Rhododendron maximum	37.5	26.3	41.3	23.8	0.0	7.5	11.3	32.5	18.8
	Rhododendron sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Rubus hispidus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Rubus spp.	0.0	1.3	0.0	0.0	2.5	0.0	0.0	0.0	0.0
	Vaccinium pallidum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vibirnum acerifolium	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0
	Viburnum nudum var. cassinoides	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0

Appendix F Continued.

Growth Form	Species or Group	MH1	MH2	MH3	MM1	MM2	MM3	MX1	MX2	MX3
Vines	Dioscorea quaternata	0.0	0.0	0.0	0.0	1.3	2.5	0.0	0.0	0.0
	Parthenocissus quinquefolia	0.0	10.0	0.0	0.0	0.0	13.8	1.3	0.0	0.0
	Smilax ecirrata	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0
	Smilax glauca	0.0	0.0	0.0	0.0	1.3	2.5	3.8	1.3	0.0
	Smilax rotundifolia	2.5	0.0	0.0	2.5	0.0	12.5	22.5	22.5	3.8
	Toxicodendron radicans	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0
	Vitis aestivalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0
Bryophytes	mosses	73.8	57.5	87.5	43.8	81.3	35.0	37.5	43.8	17.5
Ferns	Dryopteris carthusiana	20.0	63.8	0.0	8.8	11.3	0.0	0.0	0.0	0.0
	Dryopteris marginalis	0.0	0.0	0.0	0.0	5.0	2.5	0.0	0.0	0.0
	Lycopodium digitatum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Polystichum acrostichoides	0.0	0.0	0.0	3.8	3.8	2.5	0.0	0.0	0.0
	Thelypteris noveboracensis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Broadleaf Herbs	Amphicarpaea bracteata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Anemone lancifolia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Arisaema triphyllum	0.0	6.3	0.0	1.3	1.3	0.0	0.0	0.0	0.0
	Aster spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Boehmeria cylindrica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Chimaphila maculata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Conopholis americana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cypripedium spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Disporum spp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Eupatorium rugosum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Galium circaezans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Galium triflorum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Goodyera pubescens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Hexastylis virginica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3
	Lycopus americanus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Medeola virginiana	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Mitchella repens	0.0	0.0	0.0	1.3	22.5	5.0	0.0	0.0	0.0
	Osmorhiza longistylis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Oxalis acetosella	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Panax quinquefolius	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Prenanthes sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Scutellaria elliptica	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Senecio aureus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Smilacina racemosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Uvularia perfoliata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Viola blanda	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0
	Viola cucullata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Viola hastata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grasses/Sedges	Cinna arundinacea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Carex digitalis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Carex intumescens	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Carex laxiflora	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Cymophyllus fraseri	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Danthonia compressa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Luzula multiflora	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Panicum boscii	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Panicum dichotomum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix F Continued.

Growth Form	Species or Group	FH1	FH2	FH3	FX1	FX2	FX3
Trees	Acer negundo	0.0	0.0	0.0	0.0	0.0	0.0
	Acer pensylvanicum	0.0	0.0	0.0	0.0	0.0	0.0
	Acer rubrum/spicatum	22.5	3.8	2.5	56.3	16.3	5.0
	Acer saccharum	0.0	0.0	0.0	0.0	0.0	0.0
	Betula alleghaniensis	0.0	0.0	0.0	0.0	0.0	0.0
	Betula lenta	0.0	0.0	1.3	0.0	0.0	0.0
	Carya glabra	0.0	0.0	0.0	0.0	0.0	0.0
	Carya tomentosa	0.0	0.0	0.0	0.0	0.0	0.0
	Fagus grandifolia	0.0	0.0	0.0	2.5	0.0	0.0
	Fraxinus americana	0.0	0.0	0.0	0.0	0.0	0.0
	Liriodendron tulipifera	6.3	0.0	0.0	0.0	0.0	0.0
	Magnolia acuminata	0.0	0.0	0.0	0.0	0.0	0.0
	Magnolia fraseri	0.0	0.0	0.0	0.0	0.0	0.0
	Magnolia tripetala	0.0	0.0	0.0	0.0	0.0	0.0
	Nyssa sylvatica	1.3	2.5	0.0	0.0	6.3	0.0
	Oxydendrum arboreum	0.0	0.0	0.0	0.0	0.0	0.0
	Prunus serotina	0.0	0.0	0.0	0.0	0.0	0.0
	Quercus alba	18.8	2.5	0.0	0.0	0.0	0.0
	Quercus prinus	0.0	0.0	0.0	5.0	0.0	0.0
	Quercus rubra	0.0	0.0	0.0	0.0	0.0	0.0
	Quercus velutina	0.0	0.0	0.0	2.5	0.0	1.3
	Sassafras albidum	1.3	0.0	0.0	1.3	0.0	1.3
	Tsuga canadensis	3.8	25.0	1.3	6.3	2.5	0.0
Shrubs	Aralia spinosa	0.0	0.0	0.0	0.0	0.0	0.0
	Clethra acuminata	2.5	1.3	0.0	0.0	0.0	0.0
	Euonymus americanus	2.5	0.0	0.0	0.0	0.0	0.0
	Gaultheria procumbens	0.0	0.0	0.0	1.3	0.0	15.0
	Hamamelis virginiana	1.3	1.3	0.0	0.0	0.0	1.3
	Hydrangea arborescens	0.0	0.0	0.0	0.0	0.0	0.0
	Ilex montana	0.0	0.0	0.0	0.0	0.0	0.0
	Ilex opaca	12.5	3.8	0.0	5.0	1.3	1.3
	Kalmia latifolia	0.0	7.5	0.0	0.0	0.0	0.0
	Ostrya virginiana	0.0	2.5	0.0	1.3	0.0	0.0
	Prunus pensylvanica	2.5	1.3	0.0	6.3	0.0	1.3
	Rhododendron maximum	27.5	12.5	17.5	1.3	0.0	0.0
	Rhododendron sp.	0.0	0.0	0.0	0.0	0.0	0.0
	Rubus hispidus	1.3	16.3	0.0	0.0	0.0	0.0
	Rubus spp.	0.0	0.0	0.0	0.0	0.0	0.0
	Vaccinium pallidum	0.0	0.0	0.0	0.0	3.8	8.8
	Vibirnum acerifolium	0.0	0.0	0.0	0.0	0.0	2.5
	Viburnum nudum var. cassinoides	0.0	0.0	0.0	0.0	0.0	0.0

Appendix F Continued.

Growth Form	Species or Group	FH1	FH2	FH3	FX1	FX2	FX3
Vines	Dioscorea quaternata	0.0	0.0	0.0	0.0	0.0	0.0
	Parthenocissus quinquefolia	0.0	0.0	0.0	0.0	0.0	0.0
	Smilax ecirrata	0.0	0.0	0.0	0.0	0.0	0.0
	Smilax glauca	5.0	8.8	0.0	40.0	2.5	16.3
	Smilax rotundifolia	15.0	3.8	2.5	30.0	25.0	32.5
	Toxicodendron radicans	1.3	0.0	0.0	0.0	0.0	0.0
	Vitis aestivalis	0.0	0.0	0.0	1.3	0.0	0.0
Bryophytes	mosses	8.8	35.0	27.5	25.0	5.0	7.5
Ferns	Dryopteris carthusiana	0.0	0.0	0.0	0.0	0.0	0.0
	Dryopteris marginalis	0.0	0.0	0.0	0.0	0.0	0.0
	Lycopodium digitatum	0.0	0.0	0.0	0.0	0.0	0.0
	Polystichum acrostichoides	0.0	2.5	0.0	0.0	0.0	0.0
	Thelypteris noveboracensis	0.0	1.3	0.0	0.0	0.0	0.0
Broadleaf Herbs	Amphicarpaea bracteata	0.0	0.0	0.0	0.0	0.0	0.0
	Anemone lancifolia	0.0	0.0	0.0	0.0	0.0	0.0
	Arisaema triphyllum	0.0	0.0	0.0	0.0	0.0	0.0
	Aster spp.	0.0	0.0	0.0	0.0	0.0	0.0
	Boehmeria cylindrica	6.3	0.0	0.0	0.0	0.0	0.0
	Chimaphila maculata	0.0	3.8	0.0	0.0	1.3	0.0
	Conopholis americana	0.0	0.0	0.0	0.0	0.0	0.0
	Cypripedium spp.	0.0	0.0	1.3	0.0	0.0	0.0
	Disporum spp.	0.0	0.0	0.0	0.0	0.0	0.0
	Eupatorium rugosum	0.0	0.0	0.0	0.0	0.0	0.0
	Galium circaezans	0.0	0.0	0.0	0.0	0.0	0.0
	Galium triflorum	0.0	0.0	0.0	0.0	0.0	0.0
	Goodyera pubescens	0.0	0.0	0.0	0.0	0.0	0.0
	Hexastylis virginica	15.0	8.8	1.3	0.0	0.0	0.0
	Lycopus americanus	2.5	0.0	0.0	0.0	0.0	0.0
	Medeola virginiana	0.0	0.0	0.0	0.0	0.0	0.0
	Mitchella repens	12.5	32.5	3.8	76.3	0.0	2.5
	Osmorhiza longistylis	0.0	0.0	0.0	0.0	0.0	0.0
	Oxalis acetosella	0.0	0.0	0.0	0.0	0.0	0.0
	Panax quinquefolius	0.0	0.0	0.0	0.0	0.0	0.0
	Prenanthes sp.	0.0	0.0	0.0	0.0	0.0	0.0
	Scutellaria elliptica	0.0	0.0	0.0	0.0	0.0	0.0
	Senecio aureus	0.0	0.0	0.0	0.0	0.0	0.0
	Smilacina racemosa	0.0	0.0	0.0	0.0	0.0	0.0
	Uvularia perfoliata	0.0	0.0	0.0	0.0	0.0	0.0
	Viola blanda	0.0	0.0	0.0	0.0	0.0	0.0
	Viola cucullata	0.0	0.0	0.0	0.0	0.0	0.0
	Viola hastata	0.0	0.0	0.0	0.0	0.0	0.0
Grasses/Sedges	Cinna arundinacea	0.0	0.0	0.0	0.0	0.0	0.0
	Carex digitalis	0.0	0.0	0.0	0.0	0.0	0.0
	Carex intumescens	0.0	0.0	0.0	0.0	0.0	0.0
	Carex laxiflora	0.0	0.0	0.0	0.0	0.0	0.0
	Cymophyllus fraseri	0.0	0.0	0.0	0.0	0.0	0.0
	Danthonia compressa	0.0	0.0	0.0	0.0	0.0	0.0
	Luzula multiflora	0.0	0.0	0.0	0.0	0.0	0.0
	Panicum boscii	0.0	0.0	0.0	0.0	0.0	0.0
	Panicum dichotomum	0.0	0.0	0.0	0.0	0.0	0.0

Appendix F Continued.

Growth Form	Species or Group	WH1	WH2	WH3	WX1	WX2	WX3
Trees	Acer negundo	0.0	0.0	0.0	0.0	0.0	0.0
	Acer pensylvanicum	0.0	0.0	0.0	0.0	0.0	0.0
	Acer rubrum/spicatum	0.0	1.3	0.0	8.8	22.5	12.5
	Acer saccharum	0.0	0.0	0.0	0.0	1.3	0.0
	Betula alleghaniensis	0.0	0.0	0.0	0.0	0.0	0.0
	Betula lenta	2.5	0.0	0.0	2.5	1.3	0.0
	Carya glabra	0.0	0.0	0.0	1.3	1.3	0.0
	Carya tomentosa	0.0	0.0	0.0	0.0	0.0	0.0
	Fagus grandifolia	0.0	0.0	0.0	1.3	0.0	0.0
	Fraxinus americana	0.0	0.0	0.0	0.0	0.0	0.0
	Liriodendron tulipifera	0.0	0.0	0.0	0.0	0.0	0.0
	Magnolia acuminata	0.0	0.0	0.0	2.5	1.3	0.0
	Magnolia fraseri	0.0	0.0	0.0	1.3	5.0	0.0
	Magnolia tripetala	0.0	0.0	0.0	0.0	0.0	0.0
	Nyssa sylvatica	0.0	0.0	0.0	3.8	10.0	1.3
	Oxydendrum arboreum	0.0	0.0	0.0	0.0	0.0	0.0
	Prunus serotina	0.0	0.0	0.0	0.0	0.0	0.0
	Quercus alba	0.0	0.0	0.0	0.0	0.0	0.0
	Quercus prinus	0.0	0.0	0.0	13.8	33.8	5.0
	Quercus rubra	0.0	0.0	0.0	0.0	1.3	0.0
	Quercus velutina	0.0	0.0	0.0	0.0	0.0	0.0
	Sassafras albidum	0.0	0.0	0.0	0.0	0.0	0.0
	Tsuga canadensis	1.3	0.0	0.0	2.5	0.0	1.3
Shrubs	Aralia spinosa	0.0	0.0	0.0	0.0	0.0	0.0
	Clethra acuminata	0.0	0.0	0.0	0.0	0.0	0.0
	Euonymus americanus	0.0	0.0	0.0	0.0	0.0	0.0
	Gaultheria procumbens	0.0	0.0	0.0	18.8	0.0	8.8
	Hamamelis virginiana	0.0	0.0	2.5	0.0	0.0	0.0
	Hydrangea arborescens	0.0	0.0	0.0	0.0	0.0	0.0
	Ilex montana	0.0	0.0	0.0	0.0	0.0	0.0
	Ilex opaca	1.3	0.0	0.0	1.3	2.5	1.3
	Kalmia latifolia	0.0	0.0	0.0	0.0	0.0	0.0
	Ostrya virginiana	0.0	0.0	0.0	0.0	0.0	0.0
	Prunus pensylvanica	0.0	0.0	0.0	1.3	11.3	3.8
	Rhododendron maximum	38.8	20.0	32.5	0.0	0.0	5.0
	Rhododendron sp.	0.0	0.0	0.0	2.5	2.5	0.0
	Rubus hispidus	0.0	0.0	0.0	0.0	0.0	0.0
	Rubus spp.	0.0	0.0	0.0	0.0	0.0	0.0
	Vaccinium pallidum	0.0	0.0	0.0	1.3	0.0	0.0
	Vibirnum acerifolium	0.0	0.0	0.0	0.0	5.0	0.0
	Viburnum nudum var. cassinoides	0.0	0.0	0.0	0.0	0.0	0.0

Appendix F Continued.

Growth Form	Species or Group	WH1	WH2	WH3	WX1	WX2	WX3
Vines	Dioscorea quaternata	0.0	0.0	0.0	0.0	0.0	0.0
	Parthenocissus quinquefolia	0.0	0.0	0.0	0.0	0.0	0.0
	Smilax ecirrata	0.0	0.0	0.0	0.0	0.0	0.0
	Smilax glauca	1.3	0.0	0.0	3.8	1.3	2.5
	Smilax rotundifolia	1.3	0.0	0.0	11.3	13.8	7.5
	Toxicodendron radicans	0.0	0.0	0.0	0.0	5.0	1.3
	Vitis aestivalis	0.0	0.0	0.0	1.3	1.3	1.3
Bryophytes	mosses	11.3	36.3	20.0	3.8	5.0	3.8
Ferns	Dryopteris carthusiana	0.0	0.0	0.0	0.0	0.0	0.0
	Dryopteris marginalis	0.0	0.0	0.0	0.0	0.0	0.0
	Lycopodium digitatum	0.0	0.0	0.0	0.0	0.0	0.0
	Polystichum acrostichoides	0.0	1.3	0.0	0.0	3.8	0.0
	Thelypteris noveboracensis	0.0	0.0	0.0	0.0	0.0	0.0
Broadleaf Herbs	Amphicarpaea bracteata	0.0	0.0	0.0	0.0	0.0	0.0
	Anemone lancifolia	0.0	0.0	0.0	0.0	0.0	0.0
	Arisaema triphyllum	0.0	0.0	0.0	0.0	0.0	0.0
	Aster spp.	0.0	0.0	0.0	0.0	0.0	0.0
	Boehmeria cylindrica	0.0	0.0	0.0	0.0	0.0	0.0
	Chimaphila maculata	0.0	0.0	0.0	1.3	0.0	0.0
	Conopholis americana	0.0	0.0	0.0	0.0	0.0	0.0
	Cypripedium spp.	0.0	0.0	0.0	0.0	0.0	0.0
	Disporum spp.	0.0	0.0	0.0	0.0	1.3	0.0
	Eupatorium rugosum	0.0	0.0	0.0	0.0	0.0	0.0
	Galium circaezans	0.0	0.0	0.0	0.0	0.0	0.0
	Galium triflorum	0.0	0.0	0.0	0.0	0.0	0.0
	Goodyera pubescens	0.0	0.0	0.0	1.3	1.3	0.0
	Hexastylis virginica	0.0	0.0	0.0	0.0	0.0	0.0
	Lycopus americanus	0.0	0.0	0.0	0.0	0.0	0.0
	Medeola virginiana	0.0	0.0	0.0	1.3	0.0	0.0
	Mitchella repens	1.3	0.0	3.8	35.0	33.8	17.5
	Osmorhiza longistylis	0.0	0.0	0.0	0.0	0.0	0.0
	Oxalis acetosella	0.0	0.0	0.0	0.0	0.0	0.0
	Panax quinquefolius	0.0	0.0	0.0	0.0	1.3	0.0
	Prenanthes sp.	0.0	0.0	0.0	0.0	0.0	0.0
	Scutellaria elliptica	0.0	0.0	0.0	0.0	0.0	0.0
	Senecio aureus	0.0	0.0	0.0	0.0	0.0	0.0
	Smilacina racemosa	0.0	0.0	0.0	0.0	0.0	0.0
	Uvularia perfoliata	0.0	0.0	0.0	0.0	0.0	0.0
	Viola blanda	0.0	0.0	0.0	0.0	0.0	0.0
	Viola cucullata	0.0	0.0	0.0	0.0	0.0	0.0
	Viola hastata	0.0	0.0	0.0	1.3	0.0	0.0
Grasses/Sedges	Cinna arundinacea	0.0	0.0	0.0	0.0	0.0	0.0
	Carex digitalis	0.0	0.0	0.0	0.0	0.0	0.0
	Carex intumescens	0.0	0.0	0.0	0.0	0.0	0.0
	Carex laxiflora	0.0	0.0	0.0	0.0	0.0	0.0
	Cymophyllus fraseri	0.0	0.0	0.0	0.0	0.0	0.0
	Danthonia compressa	0.0	0.0	0.0	0.0	0.0	0.0
	Luzula multiflora	0.0	0.0	0.0	0.0	0.0	0.0
	Panicum boscii	0.0	0.0	0.0	0.0	0.0	0.0
	Panicum dichotomum	0.0	0.0	0.0	0.0	0.0	0.0

Appendix F Continued.

Growth Form	Species or Group	GM1	GM2	GM3	KM1	KM2	KM3
Trees	Acer negundo	0.0	0.0	1.3	0.0	0.0	0.0
	Acer pensylvanicum	6.3	7.5	1.3	0.0	0.0	0.0
	Acer rubrum/spicatum	55.0	17.5	0.0	32.5	68.8	32.5
	Acer saccharum	0.0	1.3	0.0	0.0	0.0	0.0
	Betula alleghaniensis	2.5	0.0	0.0	0.0	0.0	0.0
	Betula lenta	0.0	2.5	6.3	1.3	2.5	0.0
	Carya glabra	0.0	5.0	1.3	0.0	0.0	0.0
	Carya tomentosa	0.0	0.0	0.0	0.0	0.0	0.0
	Fagus grandifolia	0.0	0.0	0.0	0.0	0.0	2.5
	Fraxinus americana	0.0	0.0	0.0	0.0	0.0	0.0
	Liriodendron tulipifera	0.0	1.3	0.0	0.0	2.5	0.0
	Magnolia acuminata	0.0	0.0	0.0	0.0	0.0	0.0
	Magnolia fraseri	0.0	0.0	0.0	0.0	0.0	0.0
	Magnolia tripetala	0.0	0.0	0.0	0.0	0.0	0.0
	Nyssa sylvatica	0.0	1.3	0.0	0.0	0.0	0.0
	Oxydendrum arboreum	6.3	0.0	0.0	0.0	0.0	0.0
	Prunus serotina	0.0	0.0	0.0	1.3	0.0	0.0
	Quercus alba	0.0	0.0	0.0	0.0	2.5	3.8
	Quercus prinus	0.0	0.0	0.0	0.0	0.0	0.0
	Quercus rubra	0.0	0.0	0.0	0.0	1.3	1.3
	Quercus velutina	0.0	1.3	1.3	0.0	0.0	0.0
	Sassafras albidum	0.0	7.5	2.5	0.0	0.0	0.0
	Tsuga canadensis	0.0	0.0	0.0	5.0	3.8	0.0
Shrubs	Aralia spinosa	3.8	0.0	2.5	0.0	0.0	0.0
	Clethra acuminata	0.0	0.0	0.0	0.0	0.0	0.0
	Euonymus americanus	0.0	0.0	6.3	1.3	1.3	1.3
	Gaultheria procumbens	0.0	0.0	0.0	0.0	0.0	1.3
	Hamamelis virginiana	5.0	0.0	0.0	0.0	0.0	0.0
	Hydrangea arborescens	0.0	0.0	0.0	0.0	0.0	0.0
	Ilex montana	1.3	0.0	1.3	1.3	1.3	0.0
	Ilex opaca	0.0	0.0	0.0	0.0	0.0	0.0
	Kalmia latifolia	1.3	0.0	0.0	5.0	5.0	0.0
	Ostrya virginiana	0.0	0.0	0.0	0.0	0.0	0.0
	Prunus pensylvanica	0.0	0.0	0.0	0.0	0.0	0.0
	Rhododendron maximum	0.0	3.8	1.3	0.0	0.0	0.0
	Rhododendron sp.	0.0	0.0	0.0	0.0	0.0	0.0
	Rubus hispidus	0.0	0.0	2.5	0.0	2.5	0.0
	Rubus spp.	0.0	0.0	0.0	0.0	0.0	0.0
	Vaccinium pallidum	0.0	0.0	0.0	0.0	1.3	0.0
	Vibirnum acerifolium	0.0	1.3	0.0	0.0	0.0	0.0
	Viburnum nudum var. cassinoides	0.0	0.0	0.0	0.0	0.0	0.0

Appendix F Continued.

Growth Form	Species or Group	GM1	GM2	GM3	KM1	KM2	KM3
Vines	Dioscorea quaternata	0.0	0.0	0.0	5.0	2.5	0.0
	Parthenocissus quinquefolia	0.0	0.0	2.5	0.0	0.0	0.0
	Smilax ecirrata	0.0	0.0	0.0	0.0	0.0	0.0
	Smilax glauca	2.5	5.0	2.5	5.0	5.0	6.3
	Smilax rotundifolia	22.5	5.0	11.3	2.5	0.0	0.0
	Toxicodendron radicans	0.0	0.0	0.0	0.0	0.0	0.0
	Vitis aestivalis	6.3	0.0	0.0	0.0	0.0	0.0
Bryophytes	mosses	25.0	12.5	23.8	33.8	20.0	10.0
Ferns	Dryopteris carthusiana	0.0	0.0	0.0	0.0	0.0	0.0
	Dryopteris marginalis	0.0	0.0	0.0	0.0	0.0	0.0
	Lycopodium digitatum	0.0	0.0	0.0	2.5	0.0	0.0
	Polystichum acrostichoides	2.5	11.3	22.5	0.0	0.0	0.0
	Thelypteris noveboracensis	0.0	1.3	5.0	7.5	31.3	0.0
Broadleaf Herbs	Amphicarpaea bracteata	0.0	0.0	0.0	0.0	0.0	0.0
	Anemone lancifolia	47.5	1.3	3.8	8.8	10.0	3.8
	Arisaema triphyllum	0.0	0.0	2.5	0.0	0.0	0.0
	Aster spp.	0.0	0.0	0.0	1.3	0.0	0.0
	Boehmeria cylindrica	0.0	0.0	0.0	0.0	0.0	0.0
	Chimaphila maculata	0.0	1.3	0.0	0.0	0.0	0.0
	Conopholis americana	0.0	0.0	0.0	1.3	0.0	1.3
	Cypripedium spp.	5.0	0.0	0.0	0.0	0.0	0.0
	Disporum spp.	0.0	0.0	1.3	0.0	0.0	0.0
	Eupatorium rugosum	0.0	0.0	1.3	0.0	0.0	0.0
	Galium circaezans	0.0	0.0	0.0	0.0	0.0	0.0
	Galium triflorum	0.0	0.0	5.0	0.0	0.0	0.0
	Goodyera pubescens	0.0	1.3	1.3	0.0	0.0	0.0
	Hexastylis virginica	0.0	0.0	0.0	0.0	0.0	0.0
	Lycopus americanus	0.0	0.0	0.0	0.0	0.0	0.0
	Medeola virginiana	1.3	0.0	6.3	3.8	17.5	3.8
	Mitchella repens	21.3	1.3	0.0	11.3	37.5	0.0
	Osmorhiza longistylis	0.0	0.0	8.8	0.0	0.0	0.0
	Oxalis acetosella	0.0	0.0	0.0	0.0	0.0	0.0
	Panax quinquefolius	0.0	0.0	0.0	0.0	0.0	0.0
	Prenanthes sp.	0.0	0.0	0.0	0.0	0.0	1.3
	Scutellaria elliptica	0.0	0.0	0.0	0.0	0.0	0.0
	Senecio aureus	0.0	0.0	7.5	0.0	0.0	0.0
	Smilacina racemosa	0.0	0.0	0.0	0.0	0.0	1.3
	Uvularia perfoliata	0.0	0.0	2.5	0.0	0.0	0.0
	Viola blanda	0.0	0.0	0.0	0.0	0.0	0.0
	Viola cucullata	26.3	1.3	11.3	1.3	23.8	6.3
	Viola hastata	0.0	0.0	2.5	0.0	0.0	0.0
Grasses/Sedges	Cinna arundinacea	0.0	0.0	1.3	0.0	0.0	0.0
	Carex digitalis	0.0	0.0	1.3	0.0	5.0	0.0
	Carex intumescens	0.0	0.0	0.0	0.0	1.3	0.0
	Carex laxiflora	0.0	0.0	0.0	0.0	0.0	0.0
	Cymophyllus fraseri	0.0	0.0	0.0	0.0	0.0	0.0
	Danthonia compressa	0.0	0.0	0.0	0.0	1.3	0.0
	Luzula multiflora	0.0	0.0	0.0	0.0	0.0	0.0
	Panicum boscii	0.0	0.0	0.0	0.0	0.0	0.0
	Panicum dichotomum	0.0	0.0	0.0	0.0	0.0	0.0

Appendix G. List of species and authorities (Gleason and Cronquist 1991) sampled on hemlock ecosystem monitoring plots, November, 1998, through July, 1999.

Order	Family	Species	Common names used in this document
Lycopsida	Lycopodiaceae	*Lycopodium digitatum* Dillen.	
Filicopsida	Aspleniaceae	*Dryopteris carthusiana* (Villars) H.P. Fuchs	ferns
		Dryopteris marginalis (L.) A. Gray	
		Polystichum acrostichoides (Michx.) Schott.	
		Thelypteris noveboracensis (L.) Nieuwl.	
Spermatopsida	Aceraceae	*Acer negundo* L.	
		Acer pensylvanicum L.	
		Acer rubrum L.	
		Acer saccharum Marshall	
		Acer spicatum Lam.	
	Anacardiaceae	*Rhus glabra* L.	
		Toxicodendron radicans (L.) Kuntze	
	Apiaceae	*Osmorhiza longistylis* (Torr.) DC.	
	Aquifoliaceae	*Ilex montana* (T. & G.) A. Gray	
		Ilex opaca Aiton	
	Araceae	*Arisaema triphyllum* (L.) Schott.	
	Araliaceae	*Aralia spinosa* L.	
		Panax quinquefolius L.	
	Aristolochiaceae	*Hexastylis virginica* (L.) Small	
	Asteraceae	*Aster* L.	
		Eupatorium rugosum Houttuyn	
		Prenanthes L.	
		Senecio aureus L.	
	Betulaceae	*Betula alleghaniensis* Britton	
		Betula lenta L.	
		Ostrya virginiana (Miller) K. Koch	
	Caprifoliaceae	*Vibirnum acerifolium* L.	
		Viburnum nudum var. *cassinoides* (L.) T. & G.	
	Celastraceae	*Euonymus americanus* L.	
	Clethraceae	*Clethra acuminata* Michx.	
	Cornaceae	*Cornus florida* L.	
		Nyssa sylvatica Marshall	
	Cyperaceae	*Carex digitalis* Willd.	
		Carex intumescens Rudge.	
		Carex laxiflora Lam.	
		Cymophyllus fraseri (Andrews) Mackenzie	
	Dioscoreaceae	*Dioscorea quaternata* (Walter) J. F. Gmelin	

Appendix G. Continued.

Order	Family	Species	Common names used in this document
	Ericaceae	*Gaultheria procumbens* L.	
		Kalmia latifolia L.	
		Oxydendrum arboreum (L.) DC.	
		Rhododendron L.	
		Rhododendron maximum L.	great laurel
		Vaccinium pallidum Aiton	
	Fabaceae	*Amphicarpaea bracteata* (L.) Fern.	
	Fagaceae	*Fagus grandifolia* Ehrh.	
		Quercus alba L.	
		Quercus coccinea Muenchh.	
		Quercus prinus L.	
		Quercus rubra L.	
		Quercus velutina Lam.	
	Hamamelidaceae	*Hamamelis virginiana* L.	
	Hydrangeaceae	*Hydrangea arborescens* L.	
	Juglandaceae	*Carya glabra* (Miller) Sweet	
		Carya ovata (Miller) K. Koch	
		Carya tomentosa (Poiret) Nutt.	
	Juncaceae	*Luzula multiflora* (Retz.) Lej.	
	Lamiaceae	*Lycopus americanus* Muhl.	
		Scutellaria elliptica Muhl.	
	Lauraceae	*Sassafras albidum* (Nutt.) Nees.	
	Liliaceae	*Disporum* Salisb.	
		Medeola virginiana L.	
		Smilacina racemosa (L.) Desf.	
		Uvularia perfoliata L.	
	Magnoliaceae	*Liriodendron tulipifera* L.	
		Magnolia acuminata (L.) L.	
		Magnolia fraseri Walter	
		Magnolia tripetala (L.) L.	
	Oleaceae	*Fraxinus americana* L.	
	Orchidaceae	*Cypripedium* L.	
		Goodyera pubescens (Willd.) R. Br.	
	Orobanchaceae	*Conopholis americana* (L.) Wallr.	
	Oxalidaceae	*Oxalis acetosella* L.	
	Pinaceae	*Pinus strobus* L.	white pine
		Tsuga canadensis (L.) Carriere	hemlock
	Poaceae	*Cinna arundinacea* L.	
		Danthonia compressa Austin	
		Panicum boscii Poir.	
		Panicum dichotomum L.	
	Pyrolaceae	*Chimaphila maculata* (L.) Pursh.	

Appendix G. Continued.

Order	Family	Species	Common names used in this document
	Ranunculaceae	*Anemone lancifolia* Pursh	
	Rosaceae	*Prunus pensylvanica* L.f.	
		Prunus serotina Ehrh.	
		Rubus L.	
		Rubus hispidus L.	
	Rubiaceae	*Galium circaezans* Michx.	
		Galium triflorum Michx.	
		Mitchella repens L.	
	Smilacaceae	*Smilax ecirrata* (Engelm.) S. Wats.	greenbrier
		Smilax glauca Walter	
		Smilax rotundifolia L.	
	Tiliaceae	*Tilia americana* L.	
	Urticaceae	*Boehmeria cylindrica* (L.) Swartz	
	Violaceae	*Viola blanda* Willd.	
		Viola cucullata Aiton	
		Viola hastata Michx.	
	Vitaceae	*Parthenocissus quinquefolia* (L.) Planchon	
		Vitis aestivalis Michx.	